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(54) **EXPANDABLE IMPLANT**

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A61F 2/46 (2006.01)
A61F 2/30 (2006.01)

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CPC ***A61F 2/442*** (2013.01); ***A61F 2/4611*** (2013.01); *A61F 2002/304* (2013.01);
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USPC 623/17.11, 17.15, 17.16
See application file for complete search history.

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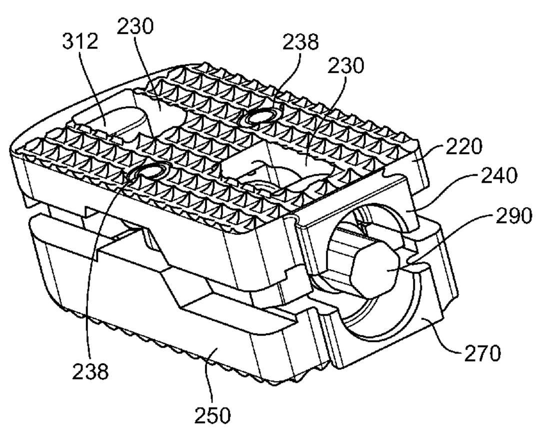
(57) **ABSTRACT**

An expandable implant (**210**, **410**) includes top and bottom plates (**220**, **250**, **420**, **450**) having angled inner surfaces (**222**, **252**, **422**, **452**) that interact with expansion members (**300**, **302**, **500**, **502**). The expansion members (**300**, **302**, **500**, **502**) may be situated on an actuator (**280**, **480**), and may include at least one vertical projection (**312**, **314**, **512**, **514**) for interacting with a recess (**230**, **430**) in the plates (**220**, **250**, **420**, **450**). In some instances, rotation of the actuator (**280**, **480**) in opposing directions about a longitudinal axis may cause the expansion members (**300**, **302**, **500**, **502**) to move toward or away from one another, thereby resulting in separation or collapse of the top and bottom plates (**220**, **250**, **420**, **450**). Pins (**316**, **516**) may also be associated with the expansion members (**300**, **302**, **500**, **502**) and received in respective slots (**318**, **518**) in the plates (**220**, **250**, **420**, **450**).

18 Claims, 15 Drawing Sheets



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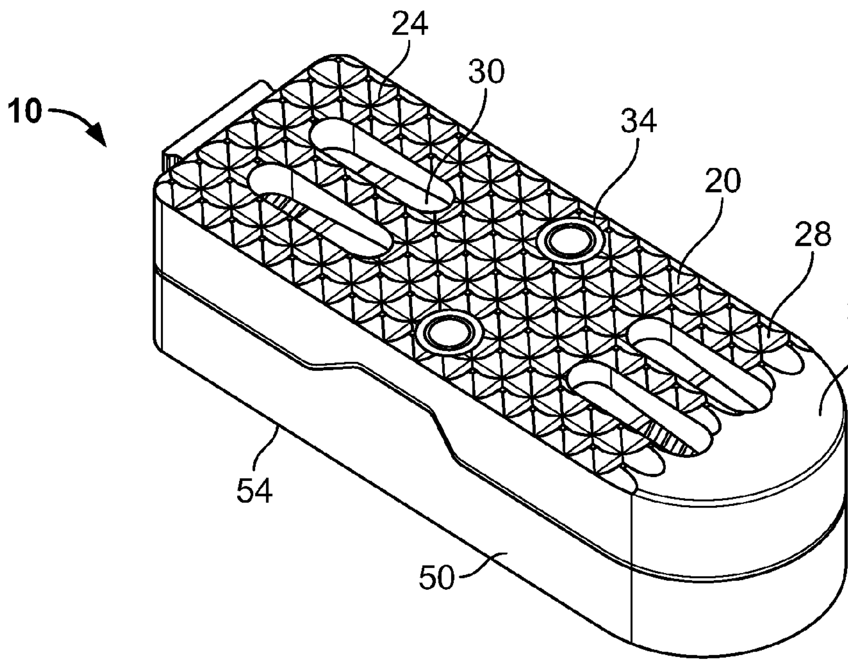

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FIG. 1A

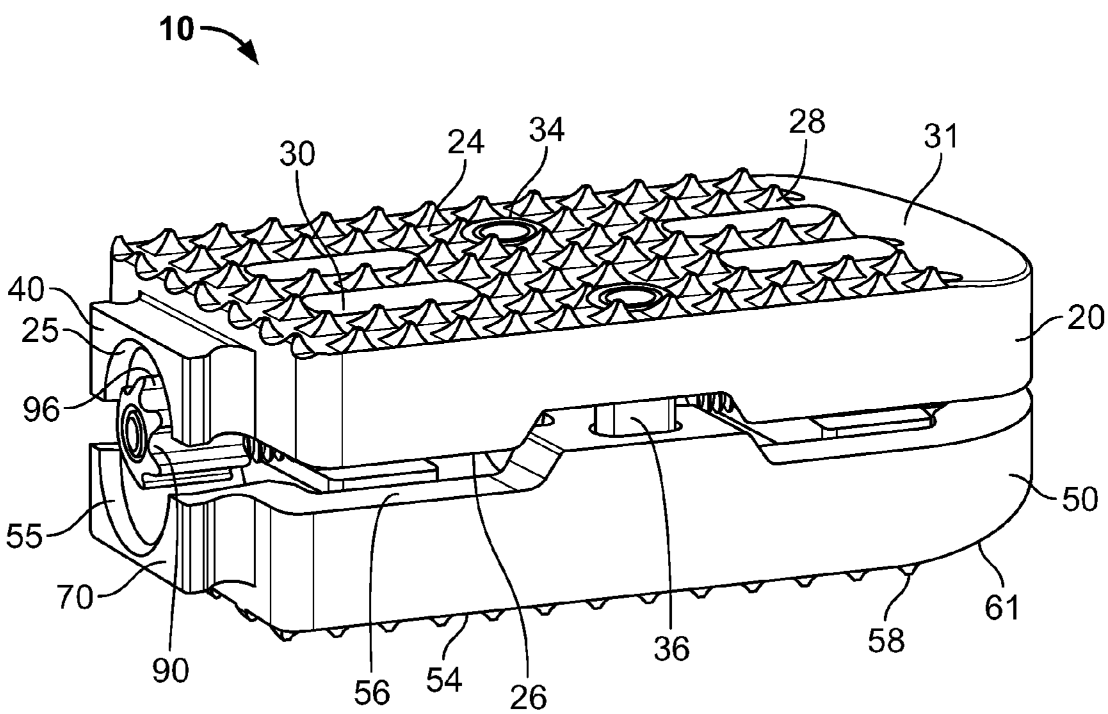

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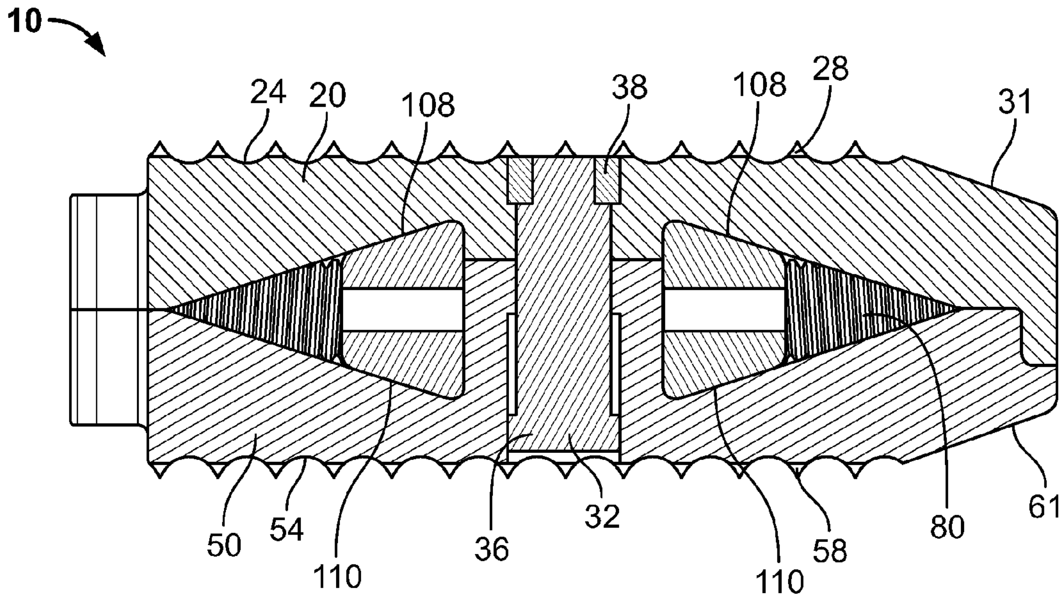
FIG. 1B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24
20
108
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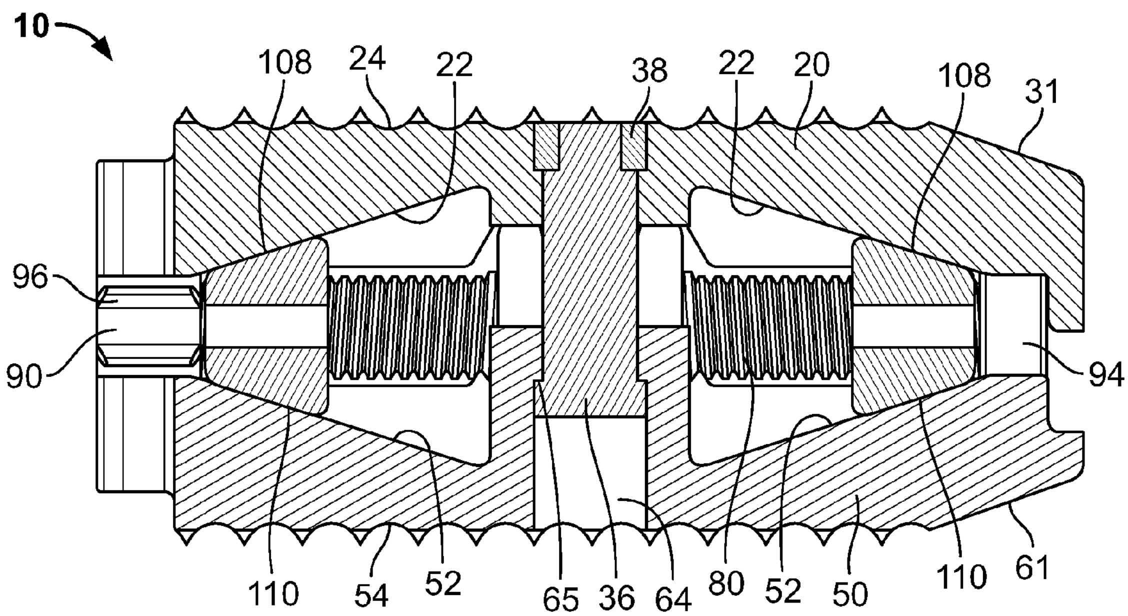
108
28
31
50
54
110
36
32
110
58
80
61

FIG. 2A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24
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38
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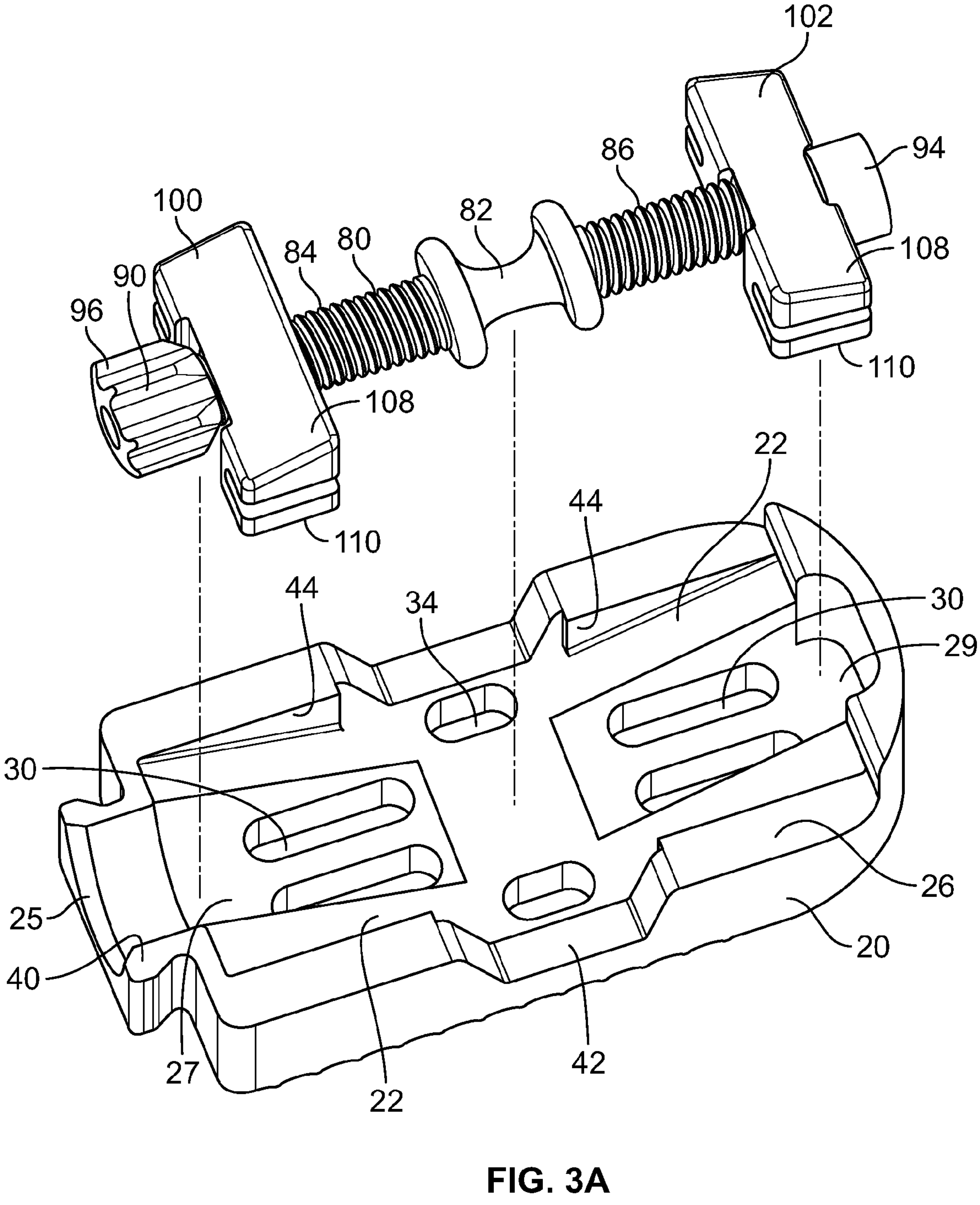
80
52
50
110
61

FIG. 2B


102
94
86
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100
84
80
108
90
96
108
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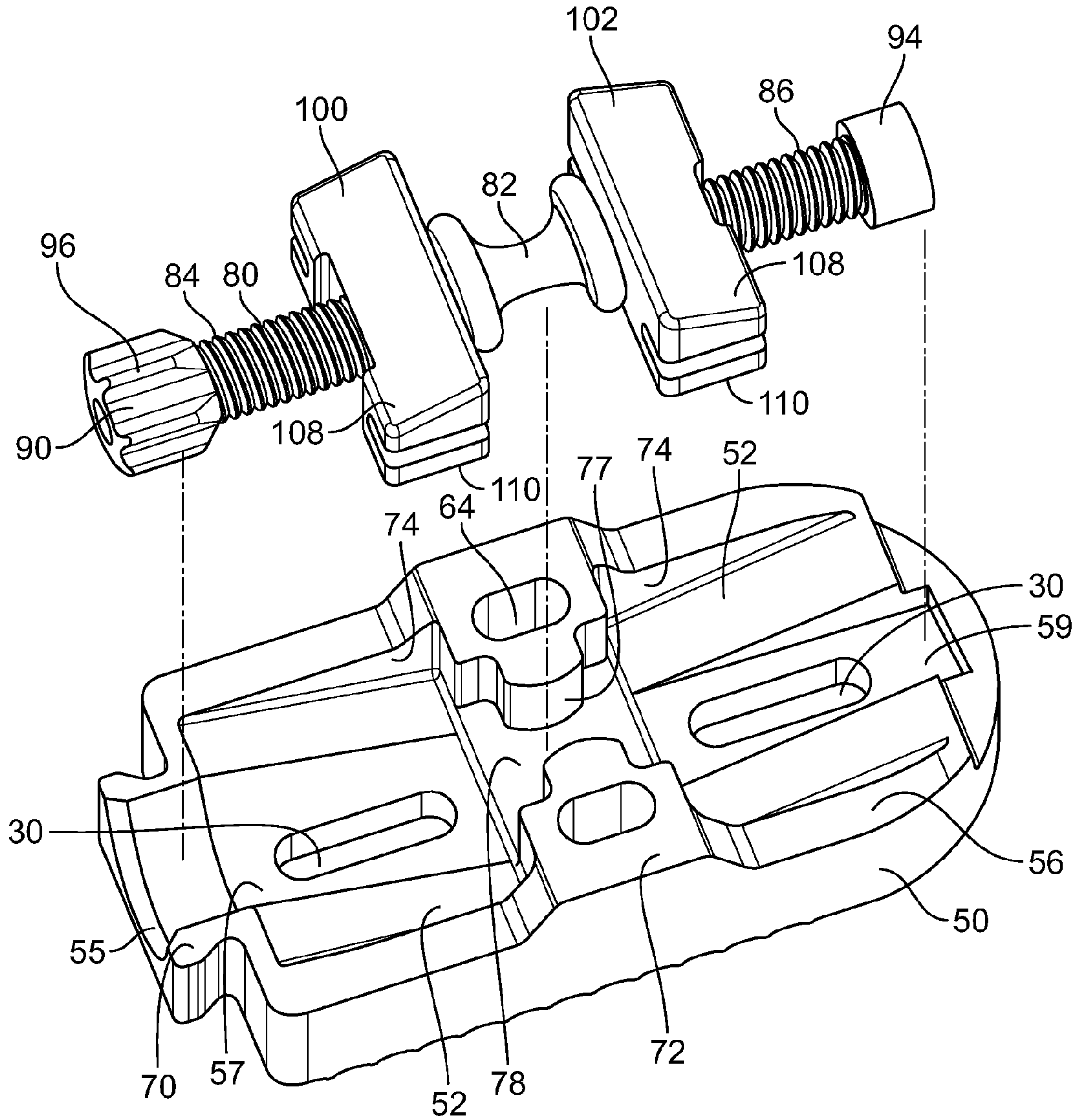
110
22
44
44
34
30
29
30
26
25
20
40
42
27
22

FIG. 3A


102
94
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86
82
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108
84
80
90
108
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110
77
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74
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30
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30
56
55
50
70
57
52
78
72

FIG. 3B

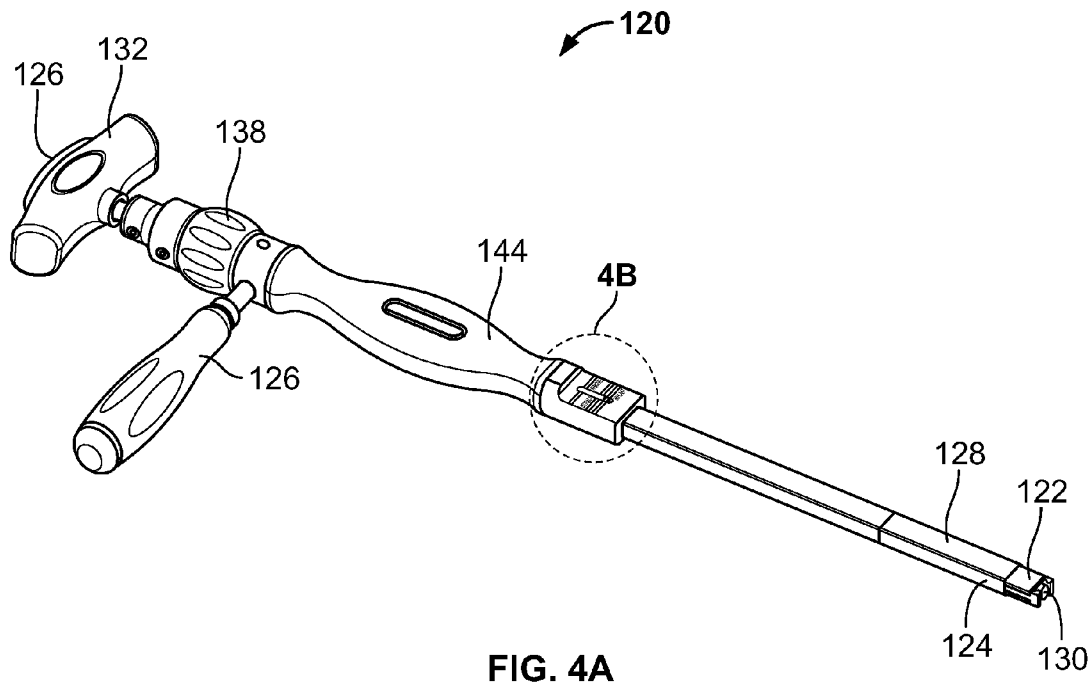

120
126
132
138
144
4B
126
128
122
124
130

FIG. 4A

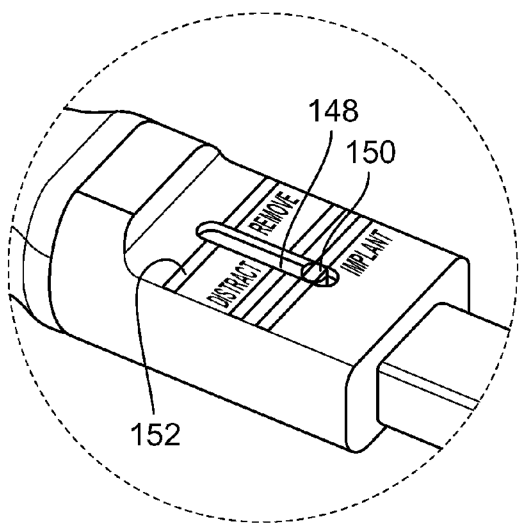

148
150
REMOVE
IMPLANT
DISTRACT
152

FIG. 4B

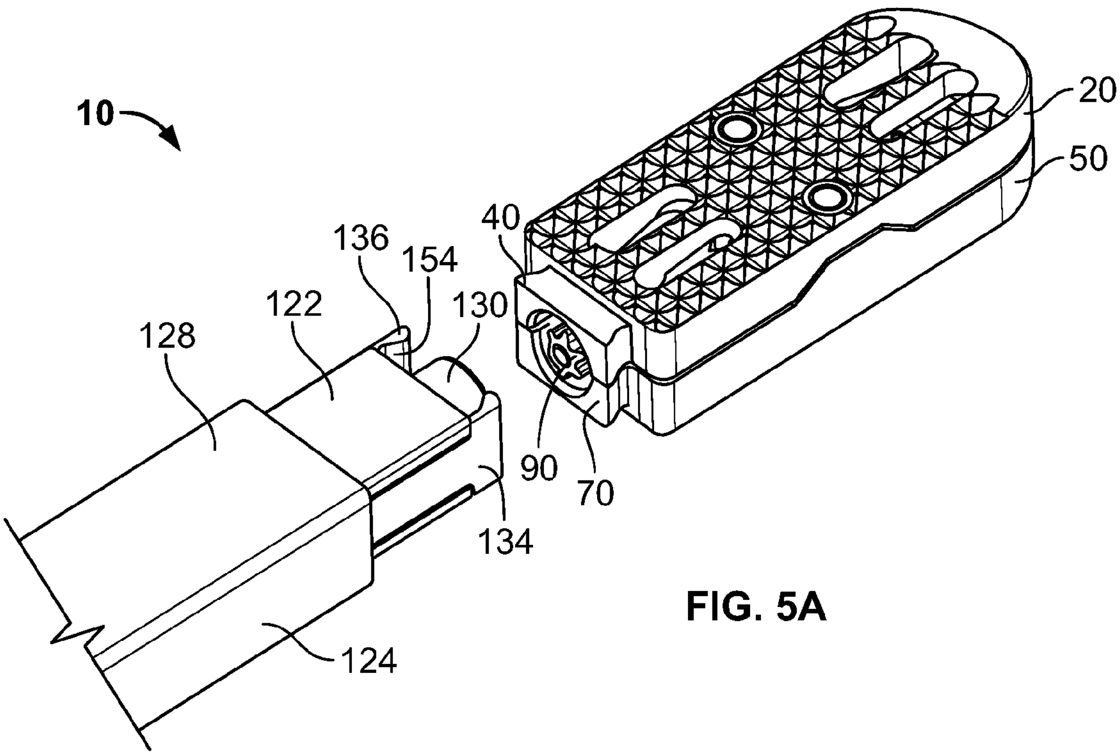

10
20
50
40
136
154
130
122
128
90
70
134
124

FIG. 5A

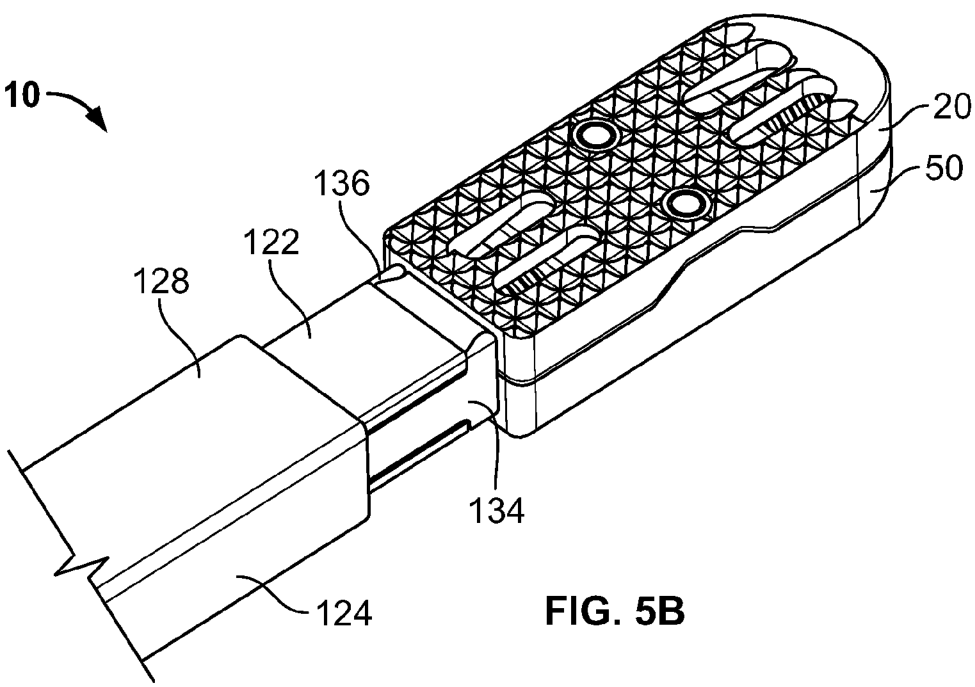

10
20
50
136
122
128
134
124

FIG. 5B

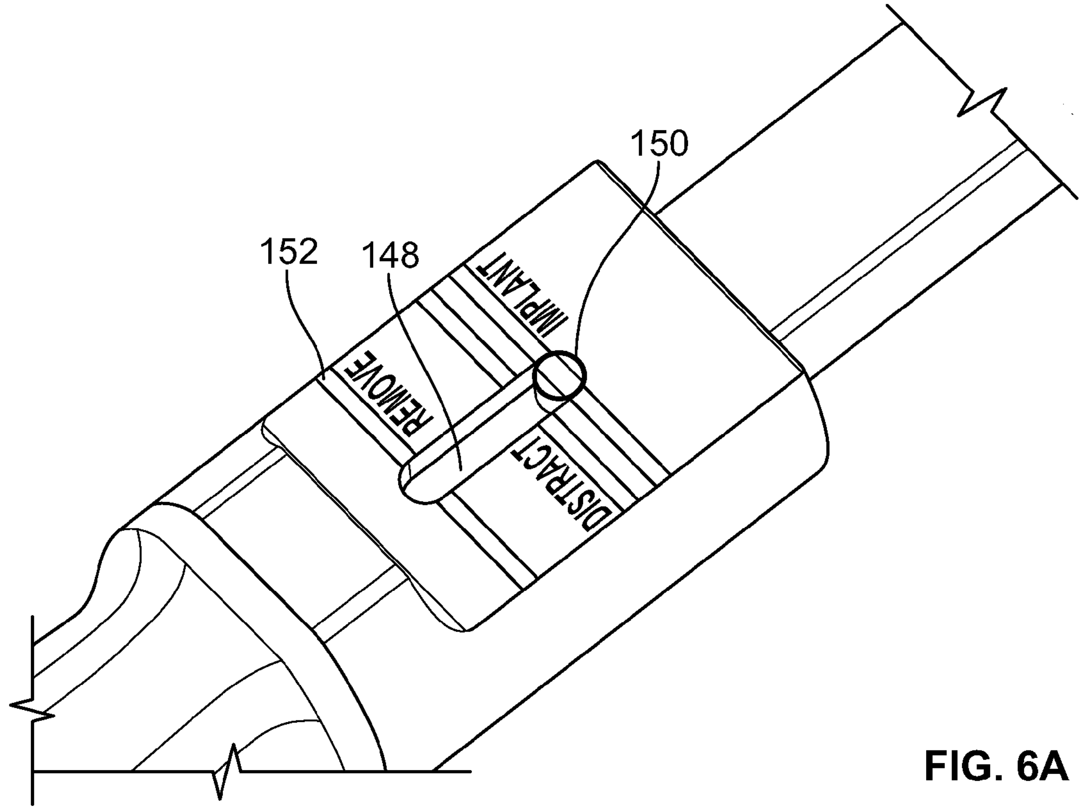

150
152
148
IMPLANT
REMOVE
DISTRACT

FIG. 6A

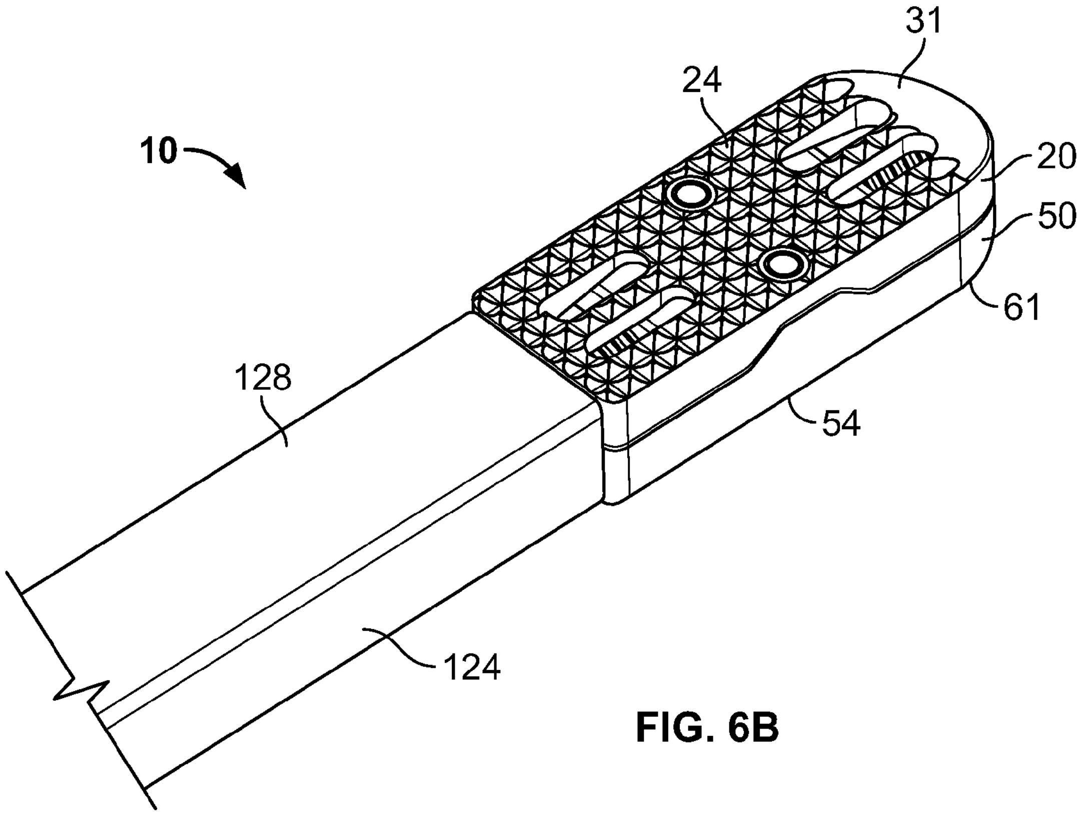

31
24
10
20
50
61
128
54
124

FIG. 6B

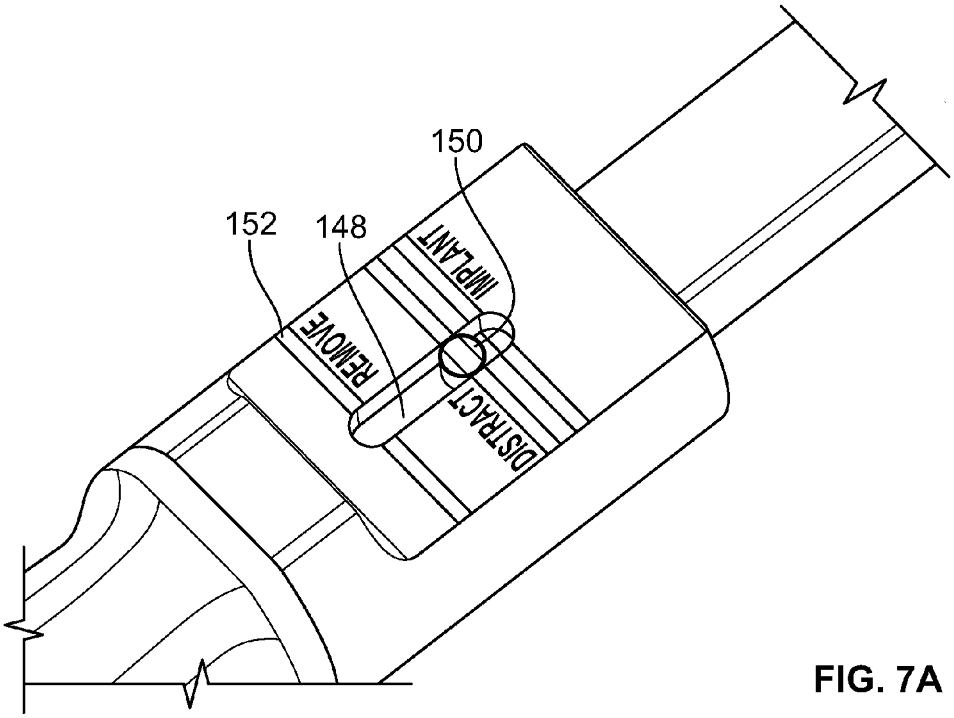
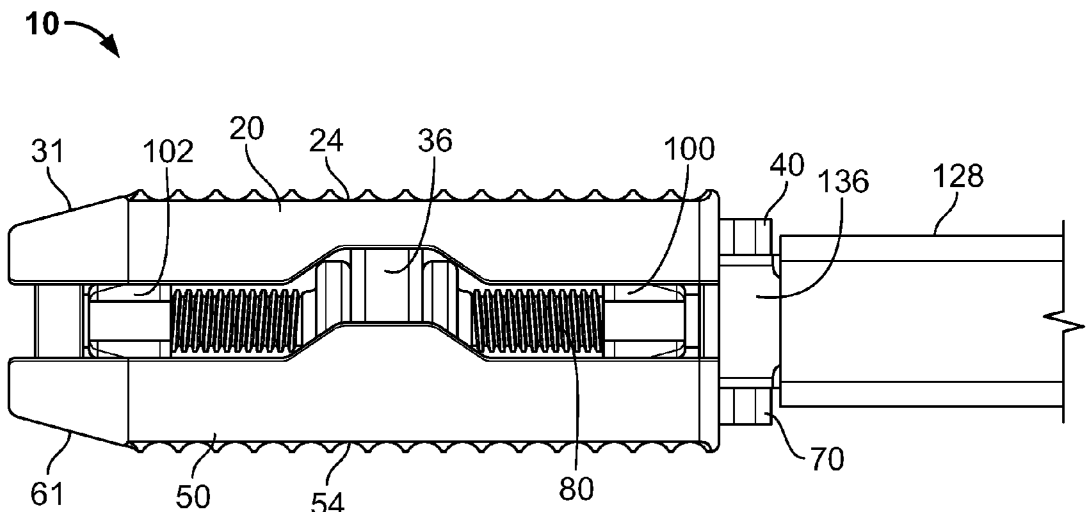

150
152
148
IMPLANT
REMOVE
DISTRACT

FIG. 7A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102
20
24
36
100
40
136
128
61
50
54
80
70

FIG. 7B

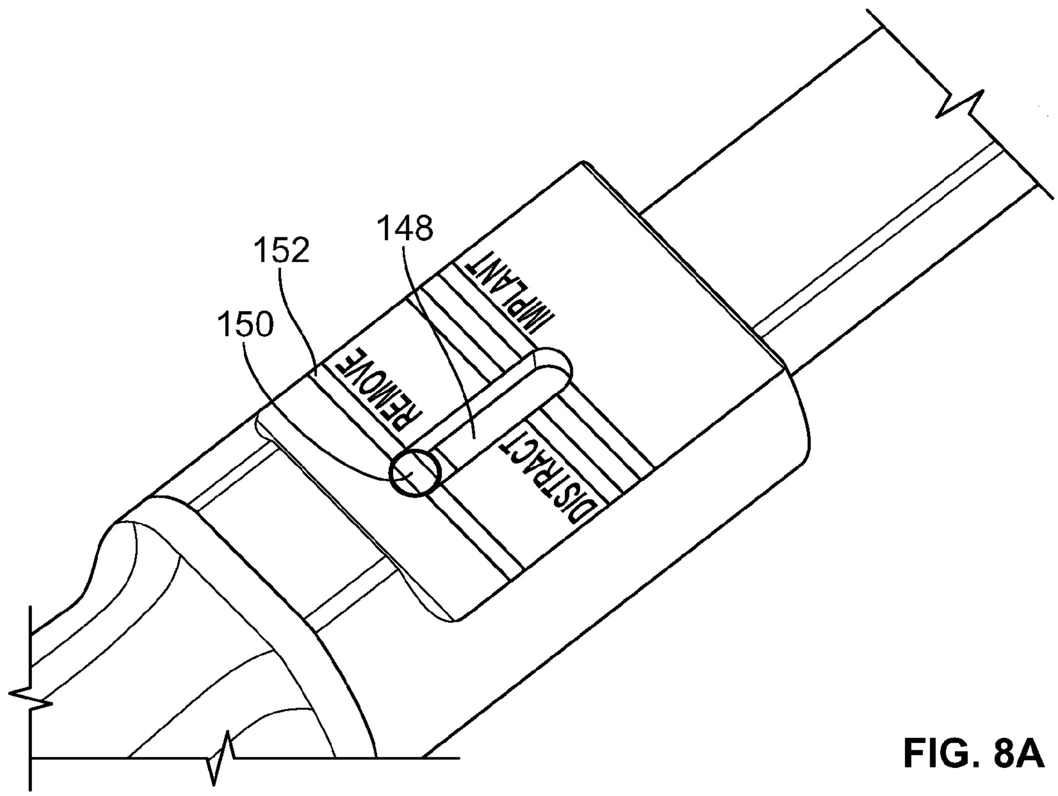

152
148
150
REMOVE
IMPLANT
DISTRACT

FIG. 8A

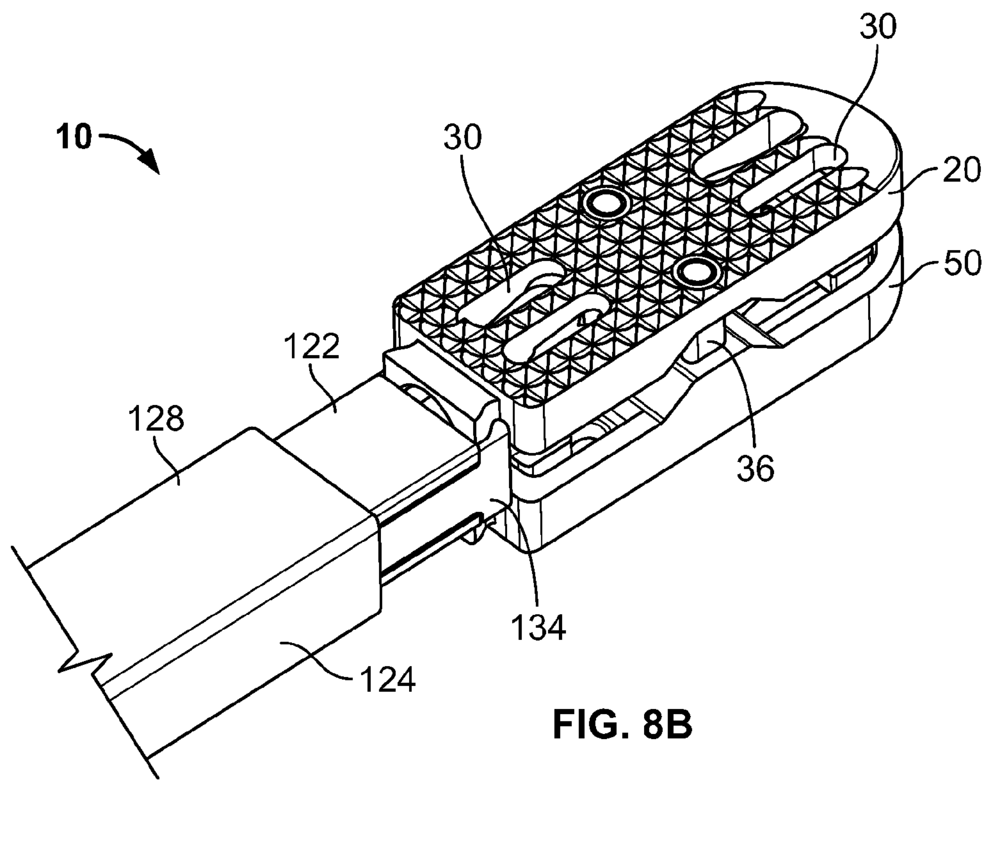
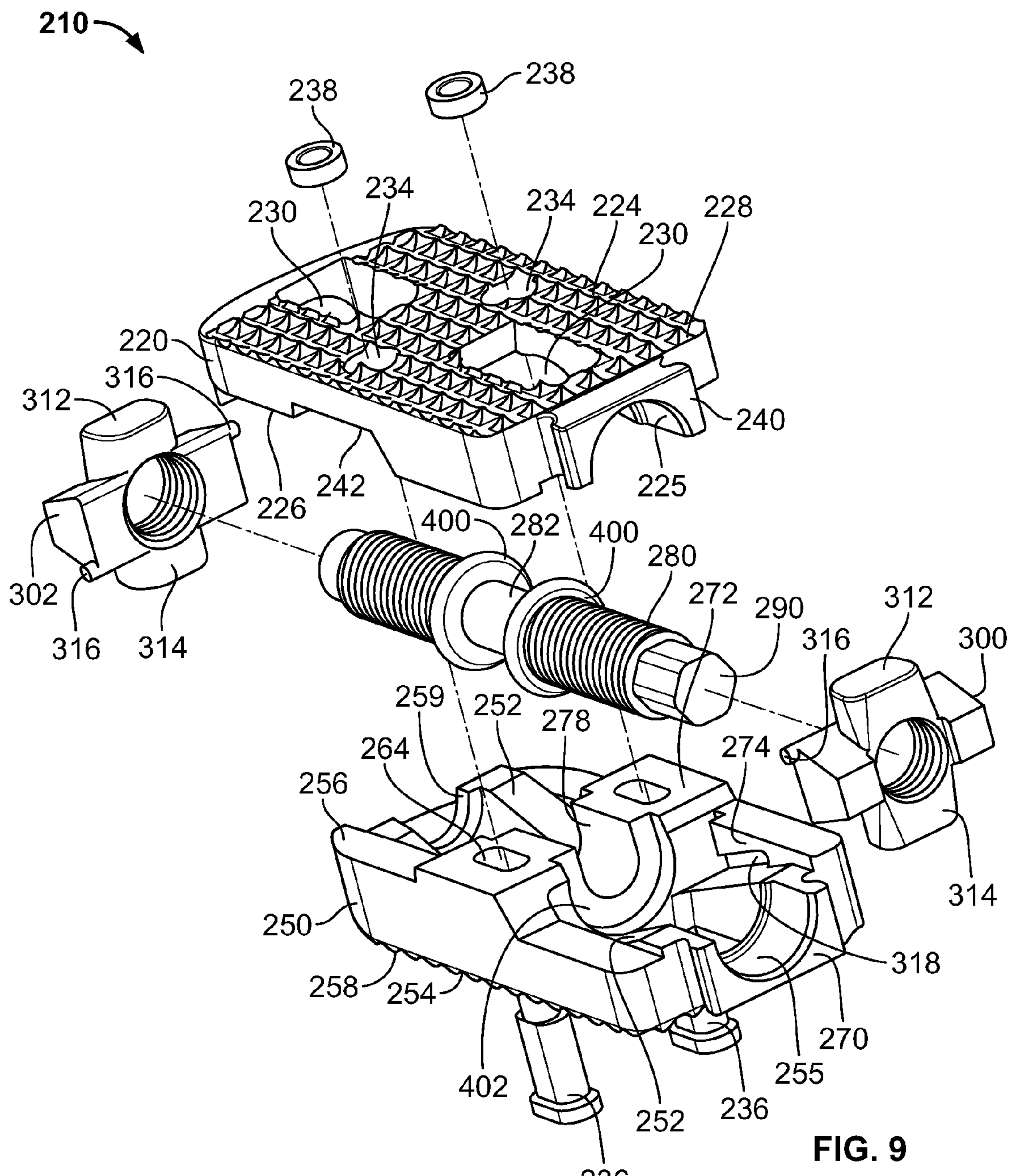

10
30
30
20
50
122
128
36
134
124

FIG. 8B


210
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238
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234
224
228
230
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316
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226
242
225
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280
302
272
290
316
314
316
312
300
259
252
278
264
274
256
250
318
314
258
254
270
255
402
252
236
236

FIG. 9

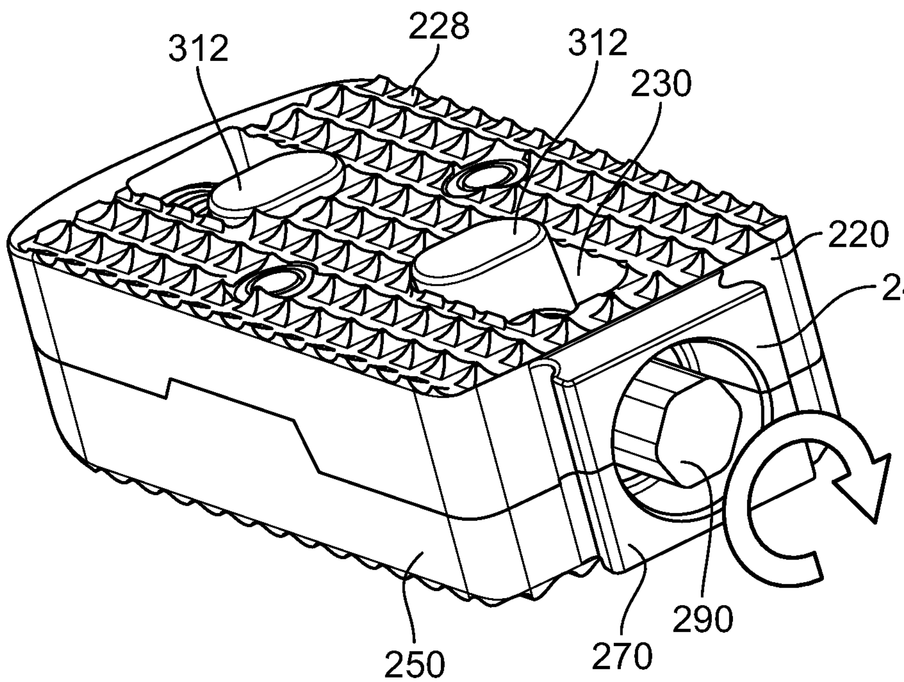


FIG. 10A

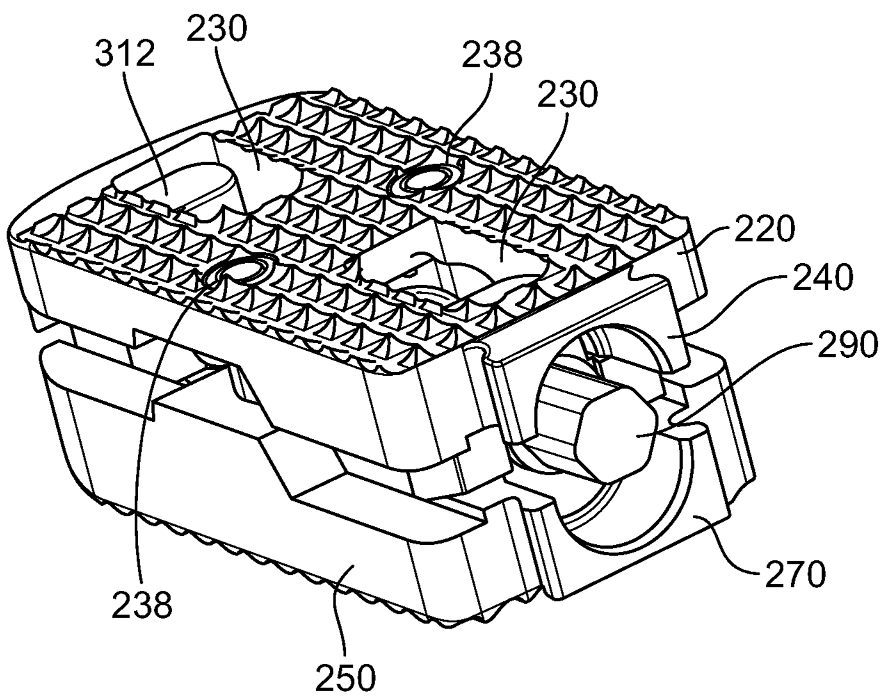


FIG. 10B

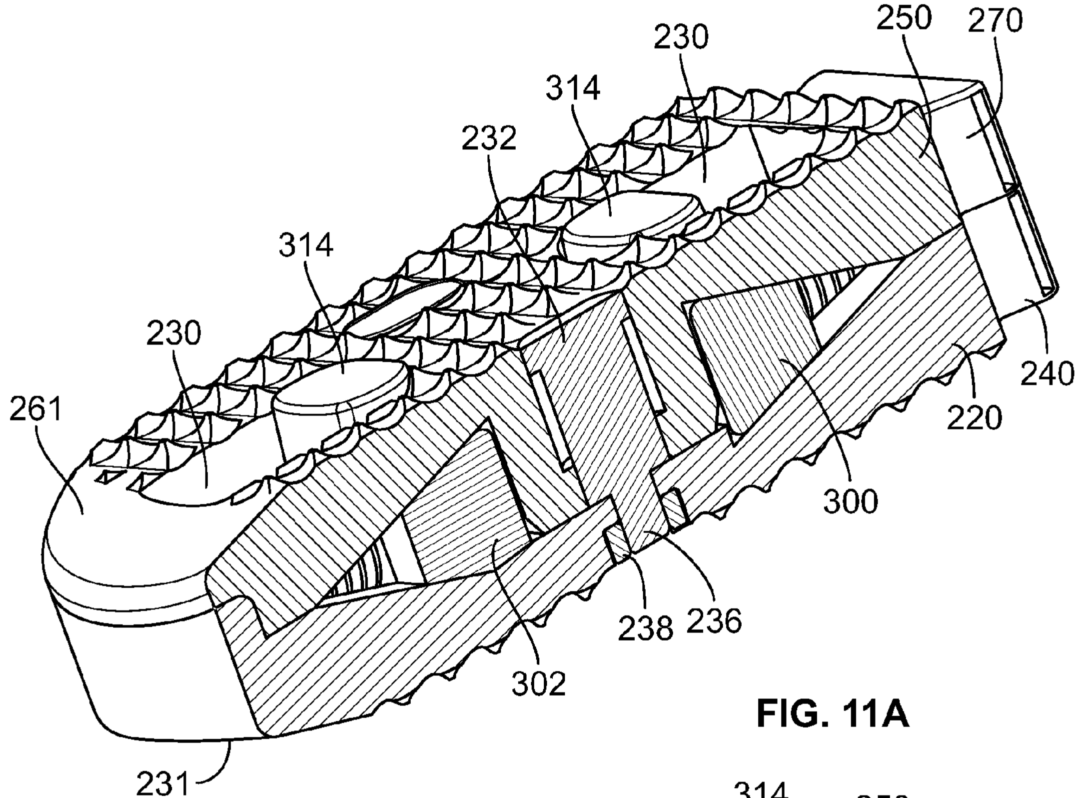


FIG. 11A

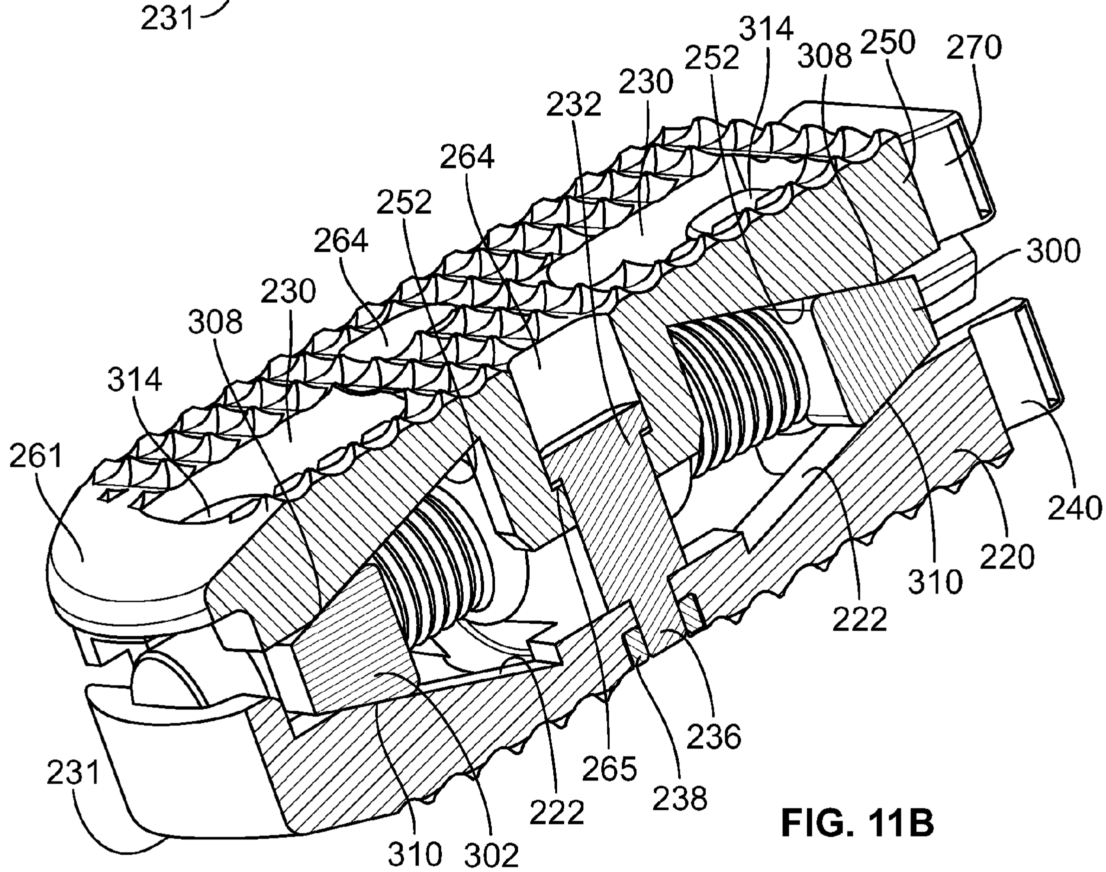


FIG. 11B

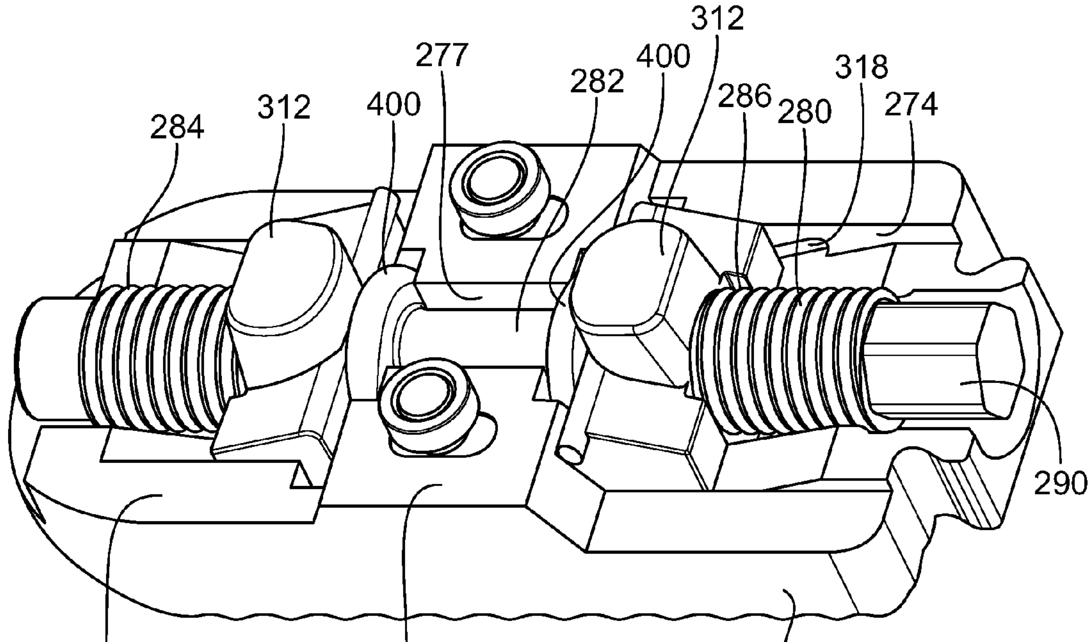


FIG. 12A

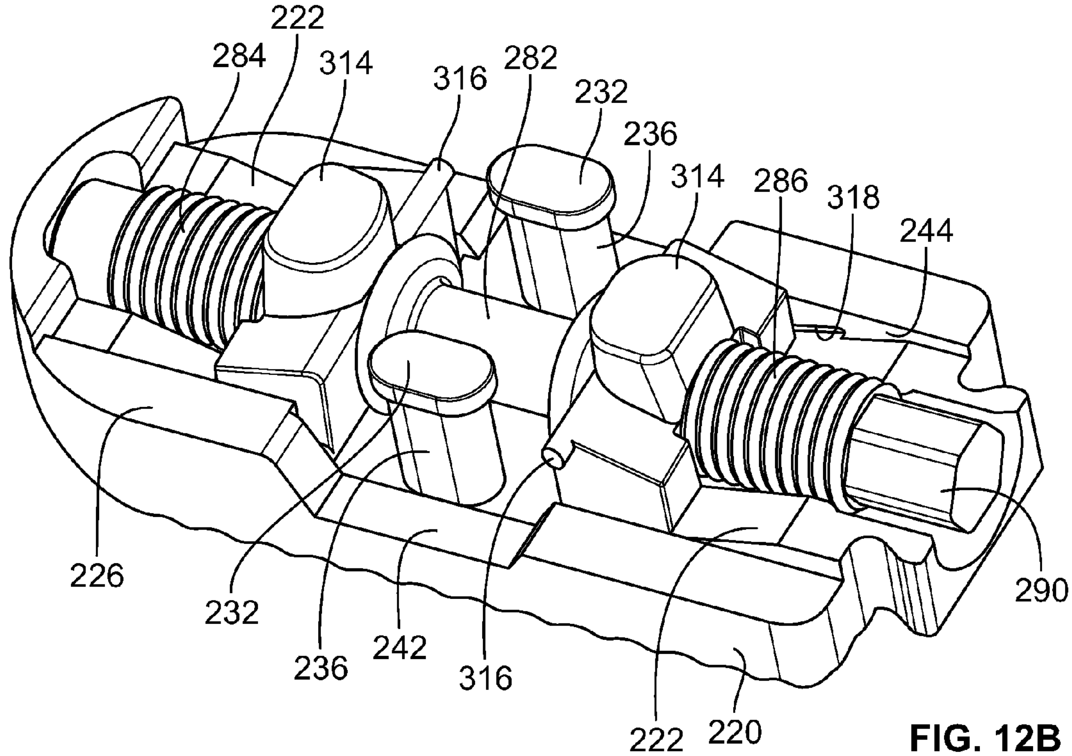


FIG. 12B

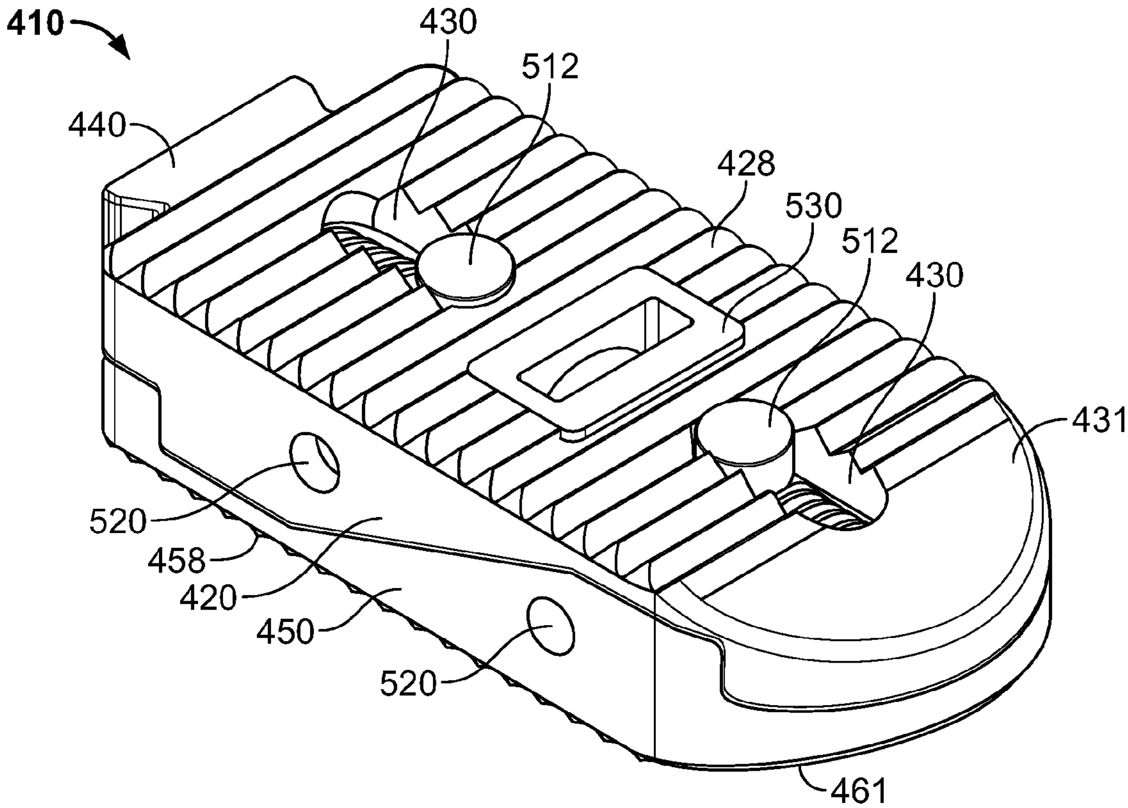


FIG. 13A

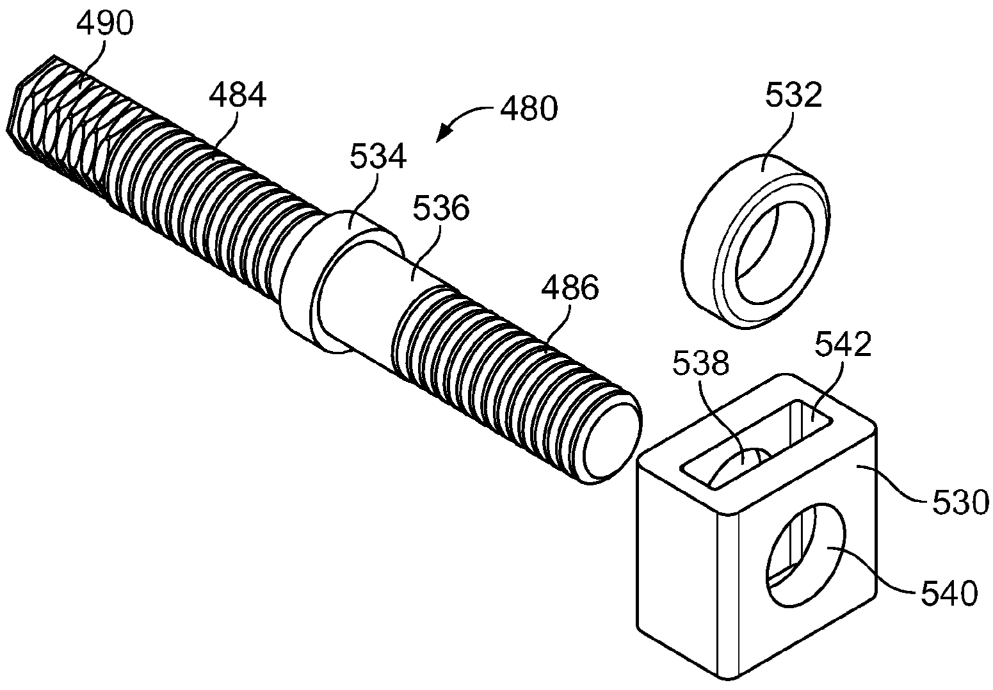
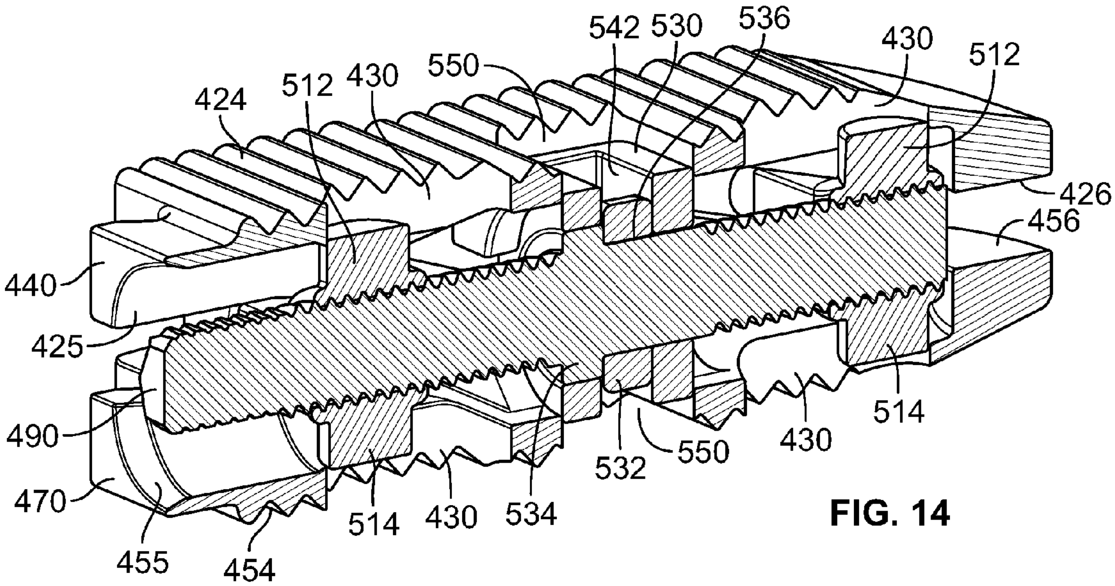


FIG. 13B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430
512
424
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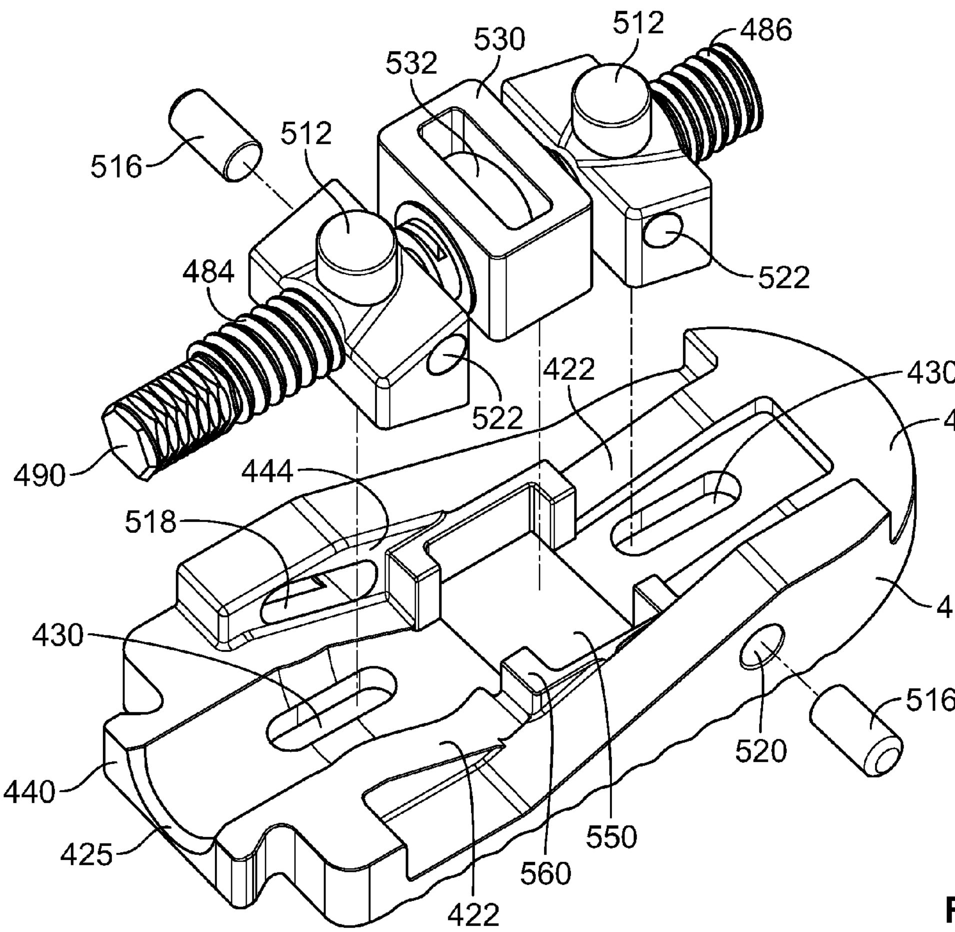
470
455
454
514
430
534
532
550
430
514

FIG. 14


530
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516
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522
484
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426
522
490
444
518
420
430
516
520
440
425
422
560
550

FIG. 15

EXPANDABLE IMPLANT

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of the filing date of U.S. Provisional Patent Application No. 61/523,981 filed Aug. 16, 2011, the disclosure of which is hereby incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to expandable implants and tools for the insertion of such implants. More particularly, the invention pertains to an expandable spinal implant having opposed plates, which are expandable via wedge members and ramped surfaces included on the plates. An insertion instrument used for implantation of the implant, and methods of utilizing the same, are also disclosed.

BACKGROUND OF THE INVENTION

Common degenerative spinal diseases, such as chronic degeneration of an intervertebral disc of the spine, may result in substantial pain and discomfort for a patient. Frequently, diseases of this type need to be treated through surgical intervention, which may include replacing the affected disc(s) and potentially fusing the associated vertebrae through the use of an implant or other like device. In particular applications, adjacent vertebral bodies may be fused via an implant, through screw arrangements, and/or by using bone graft material to secure the vertebrae in a fixed state. Exemplary indications for such devices include, but are not limited to, spinal stenosis, degenerative disc disease with a loss of disc height, disc herniation, spondylolisthesis, retrolisthesis, and disogenic back pain.

In replacing a diseased intervertebral disc(s) and effecting fusion, it may also be necessary to ensure that proper spacing is maintained between the vertebral bodies. Stated differently, once the implant or other like device is situated between adjacent vertebrae, the implant or device should adequately recreate the spacing previously maintained via the excised intervertebral disc (e.g., in its natural condition). Various expandable implants have been designed for this purpose. As such, it is possible for a surgeon to adjust the height of particular intervertebral implants to intra-operatively tailor the implant height to match the natural spacing between vertebrae, or any desired implant height. This may reduce the number of different implants needed to accommodate the varying anatomical confines of different patients.

Certain components of expandable implants, however, such as plates forming a part thereof, may be subject to torsional forces and/or compressive forces upon distraction or implantation. In some cases, the expansion mechanism of the implant may serve to keep the plates in alignment with one another to counteract these forces. In addition, rods or support bars have been used to inhibit the effect of torsional forces acting on the plates.

Although several versions of expandable intervertebral implants are known, the need for an improved expandable implant, which is expandable in situ and provides structures for keeping plates of the expandable implant in alignment with one another remains.

BRIEF SUMMARY OF THE INVENTION

A first aspect of the invention provides an expandable intervertebral implant having top and bottom plates with

inner and outer surfaces, the inner surfaces facing each other and each having a ramp surface and a recess disposed adjacent the ramp surface. An actuator is also situated between the inner surfaces of the top and bottom plates, and first and second expansion members are coupled to the actuator and located between the inner surfaces of the top and bottom plates. In some cases, the first and second expansion members each have at least one vertical projection extending outwardly therefrom. Rotation of the actuator in opposing directions may cause the first and second expansion members to move toward and away from one another along a longitudinal axis of the actuator, resulting in movement of the top and bottom plates toward and away from one another along a vertical axis perpendicular to the longitudinal axis. The at least one vertical projection of the first and second expansion members may also be received and guided at least partially within one of the recesses adjacent the ramp surfaces of the top or bottom plates while such plates move along the vertical axis.

In embodiments of the first aspect, the first and second expansion members may also each include at least one lateral projection received within a corresponding lateral slot situated adjacent the ramp surface of each of the top and bottom plates. The actuator may also include first and second threaded portions, the first and second threaded portions having oppositely facing threads configured to engage threads of the first and second expansion members, such that when the actuator is rotated, the first and second expansion members move along the longitudinal axis of the actuator in opposite directions.

In a second aspect of the invention, an expandable intervertebral implant is provided in which the implant comprises top and bottom plates having inner and outer surfaces, the inner surfaces facing each other and each having a ramp surface. An actuator may also be situated between the inner surfaces of the top and bottom plates, and first and second expansion members may be coupled to the actuator and located between the inner surfaces of the top and bottom plates, the first and second expansion members each having a horizontal portion with at least one projection extending outward therefrom. Rotation of the actuator in opposing directions may cause the horizontal portion of the first and second expansion members to translate along the ramp surfaces toward and away from one another along a longitudinal axis of the actuator, resulting in movement of the top and bottom plates toward and away from one another along a vertical axis perpendicular to the longitudinal axis, the projections of the horizontal portions being received within at least one lateral slot situated adjacent each ramp surface as the top and bottom plates move along the vertical axis.

In some embodiments of the second aspect, the inner surfaces of the top and bottom plates each include a recess adjacent the respective ramp surface, and the first and second expansion members each include a vertical portion adapted to translate within the recesses during movement of the top and bottom plates along the vertical axis. Other embodiments include the horizontal portion of the first and second expansion members having at least a first and second projection extending therefrom, the first projection being received within a lateral slot situated adjacent the ramp surface of the top plate, and the second projection being received within a lateral slot situated adjacent the ramp surface of the bottom plate. The lateral slots may also each include a terminal portion, and the first and second projections may be adapted to interact with the terminal portion to prevent movement of the first and second expansion members away from one another.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the subject matter of the present invention(s) and of the various advantages thereof can be realized by reference to the following detailed description in which reference is made to the accompanying drawings in which:

FIGS. **1**A-B are perspective views of an expandable implant according to one embodiment of the present invention, with FIG. **1**A showing the implant in collapsed form, and FIG. **1**B showing the implant expanded.

FIGS. **2**A-B are cross-sectional views of the implant of FIGS. **1**A-**1**B.

FIGS. **3**A-B are exposed views of the top and bottom plates, respectively, of the implant of FIGS. **1**A-**1**B, with the distraction mechanism shown alongside the relevant plate.

FIGS. **4**A-B are perspective views of an instrument used for implantation, removal, and distraction of an expandable implant.

FIGS. **5**A-B are perspective views of the instrument of FIGS. **4**A-B, in which the instrument is being attached to the implant.

FIGS. **6**A-B are perspective views of the instrument of FIGS. **4**A-B, with the instrument configured for implantation of the implant.

FIGS. **7**A-B depict the instrument of FIGS. **4**A-B, in which the instrument is configured for distraction of the implant.

FIGS. **8**A-B are perspective views of the instrument of FIGS. **4**A-B, with the instrument configured to be removed from the implant.

FIG. **9** is an exploded view of another embodiment of an expandable implant according to the present invention.

FIGS. **10**A-B are perspective views of the implant of FIG. **9** in collapsed and expanded orientations, respectively.

FIGS. **11**A-B are cross-sectional views of the implant of FIGS. **10**A-B.

FIGS. **12**A-B are exposed views of the bottom and top plates, respectively, of the implant of FIG. **9**.

FIG. **13**A is a perspective view of an alternate expandable implant according to one embodiment of the present invention, while FIG. **13**B is an exploded view of the distraction mechanism used with that implant.

FIG. **14** is a cross-sectional view of the implant of FIG. **13**A.

FIG. **15** is an exposed view of one of the plates of the implant of FIG. **13**A, the other plate being a mirror image thereof.

DETAILED DESCRIPTION

In describing the preferred embodiments of the invention (s) illustrated and to be described with respect to the drawings, specific terminology will be used for the sake of clarity. However, the invention(s) is not intended to be limited to any specific terms used herein, and it is to be understood that each specific term includes all technical equivalents, which operate in a similar manner to accomplish a similar purpose. For instance, while the terms "top" and "bottom" are used herein, such terms are utilized merely for convenience, and it is contemplated that the various implants disclosed may be situated in several orientations, such that these spatial terms may not apply (e.g., they may be reversed).

Referring to FIGS. **1**A-**3**B, there is shown one embodiment of an expandable implant **10**, which in some cases may be used as an intervertebral implant, the expandable implant **10** having, generally: (1) top and bottom plates **20**, **50** situated in opposition to one another; (2) a rod or axle **80** arranged between the top and bottom plates **20**, **50**; and (3) expansion members **100**, **102** for contacting angled surfaces **22**, on top and bottom plates **20**, **50**, respectively, and for expanding the implant **10** (e.g., in situ). In use, implant **10** may be inserted between adjacent vertebral bodies and expanded through use of an instrument, such as instrument **120** shown in FIGS. **4**A-B, for example. This system provides a surgeon, nurse, or other skilled practitioner (hereinafter "the user") with an improved expandable implant **10** for use in interventional procedures designed to combat various degenerative disorders, for example.

Referring to FIGS. **1**A-B, top and bottom plates **20**, **50** may include outer bone-contacting surfaces **24**, **54** and inner surfaces **26**, **56** opposed to the outer surfaces **24**, **54**. In one embodiment, outer bone-contacting surfaces **24**, **54** may include teeth, notches, serrations, keels, or other bone-penetrating features **28**, **58** for engaging bone during use. An end of top and bottom plates **20**, **50** may also be tapered **31**, **61** for facilitating implantation of implant **10**, in one embodiment. Top plate **20** may also include, as shown in FIG. **1**A, multiple elongate apertures **30** for facilitating bone in-growth or for receiving other biocompatible materials, for example. In some cases, top plate **20** may include four elongate apertures **30**, while bottom plate **50** may only include two, as reflected in FIGS. **3**A-B, respectively. A separate set of apertures **34**, **64** may also be formed in plates **20**, **50** for receiving a post(s) **36** and nut(s) **38** construct, as shown in FIGS. **2**A-B. In one embodiment, apertures **34** in top plate **20** may be generally thin in comparison to the elongate nature of apertures **64** in bottom plate **50**, thereby guiding and facilitating movement of posts **36** in apertures **64**. Each of plates **20**, **50** may also include a projection **40**, **70**, which in one embodiment may be dovetail-shaped.

Inner surfaces **26**, **56** of top and bottom plates **20**, **50**, as shown, respectively, in FIGS. **3**A-**3**B may each include angled surfaces **22**, **52** on either side of a center of the plate **20**, **50**. In particular, referring to FIG. **3**B, bottom plate **50** may include a raised center **72** having apertures **64**, and on either side of center **72** may be an angled surface(s) **52**. Such surfaces **52** may also be angled in a direction extending from respective ends of plate **50** to raised center **72**. Likewise, referring to FIG. **3**A, top plate **20** may include a recessed center **42** having apertures **34**, and on either side of recessed center **42** may be an angled surface(s) **22**. Further, such surfaces **22** may be angled in a direction extending from respective ends of plate **20** to recessed center **42**. Thus, angled surfaces **22**, **52** of plates **20**, **50** may converge towards one another, in one embodiment, as shown in FIGS. **3**A-B.

Angled surfaces **22**, **52** of plates **20**, **50** may also be bounded by adjacent side walls **44**, **74** for guiding expansion members **100**, **102**, as described in detail below. Further: (1) raised center portion **72** may include a cutout **78** for accommodating an hourglass-shaped structure **82**; (2) one end of each plate **20**, **50** may include a semi-cylindrical cutout **29**, **59** for accommodating part of axle **80**; and (3) dovetail-shaped projections **40**, **70** may each include a semi-cylindrical opening **25**, **55** for receiving another portion of axle **80**. Inner surfaces **26**, **56** of plates **20**, **50** may also include a channel **27**, **57** for housing axle **80**.

Referring still to FIGS. **3**A-B, axle **80** may be situated between plates **20**, **50**, and may include an hourglass-shaped member **82**. First and second threaded sections **84**, **86** may also be arranged on opposite sides of hourglass-shaped member **82**, such sections **84**, **86** having opposed right and left-handed threading. In other words, as an example, threaded section **84** may be situated on one side of hourglass-shaped member **82** and include left-hand threads, while threaded section **86** may be positioned on an opposing side of hourglass-shaped member **82** and include right-hand threads.

Expansion members **100**, **102** may also be situated on axle **80**, such members **100**, **102** each including an internallythreaded bore (not shown) for receiving one of threaded sections **84**, **86**. In some embodiments, expansion members **100**, **102** may include top and bottom surfaces **108**, **110** angled in opposition to angled surfaces **22**, **52** and in opposition to one another. Stated differently, top surfaces **108** of expansion members **100**, **102** may be angled to seat flush with angled surfaces **22** of top plate **20**, while bottom surfaces **110** of expansion members **100**, **102** may be angled to seat flush with angled surfaces **52** of bottom plate **50**, as shown in detail in FIGS. **2**A-B. As such, top and bottom surfaces **108**, **110** of expansion members **100**, **102** may form a wedge.

At one end of axle **80** there may also be an engagement nut **90**, while at an opposing end of axle **80** may be stop nut **94**. Engagement and/or stop nuts **90**, **94** may either be separate components threaded onto axle **80**, or, in some embodiments, may be unitarily formed with axle **80**. Engagement nut **90** includes ridges or serrations **96** on an exterior surface thereof for attaching with a portion of instrument **120**, and stop nut **94** comprises a smooth and enlarged exterior surface for interacting with a portion of expansion members **100**, **102**. In one embodiment, ridges **96** on engagement nut **90** may form a Torx structure.

To construct implant **10**, top and bottom plates **20**, **50** may first be situated in opposition to one another with inner surfaces **26**, **56** facing towards each other. Axle **80**, previously assembled to include expansion members **100**, **102**, and engagement **90** and stop **94** nuts, may also be situated between plates **20**, **50** and within channels **27**, **57**. In this configuration, top surfaces **108** of expansion members **100**, **102** may engage with angled surfaces **22** of top plate **20**, and bottom surfaces **110** of expansion members **100**, **102** may engage with angled surfaces **52** of bottom plate **50**, as shown in FIGS. **2**A-B. Further, engagement nut **90** may be surrounded by semi-cylindrical openings **25**, **55** of dovetail-shaped projections **40**, **70**, and stop nut **94** by semi-cylindrical openings **29**, **59**. An end of posts **36**, which in some cases includes an enlarged head **32**, may also be accommodated within apertures **64** in bottom plate **50**, and a stop surface **65** within each aperture **64** may prevent passage of head **32** completely through the aperture **64** (FIG. **2**B). An opposing end of posts **36**, which in some instances includes threading, may also be situated within apertures **34** in top plate **20** and be engaged with nuts **38** housed in apertures **34**. As such, plates **20**, **50** may be connected together via posts **36**, which may allow expansion of implant **10** through movement of heads **32** within apertures **64** in bottom plate **50**, as shown in detail in the progression between FIGS. **2**A-B.

With plates **20**, **50** connected together as described above, and in an unexpanded state (FIGS. **1**A, **2**A), raised center section **72** of bottom plate **50** may be accommodated within recessed center section **42** of top plate **20**, and a perimeter of inner surfaces **26**, **56** may be in contact with one another. Further, hourglass-shaped member **82** of axle **80** may be situated within the cutout **78** in bottom plate **50**. What is more, protrusions **77** extending into cutout **78** may engage a portion of hourglass-shaped member **82** to stabilize axle **80** along a longitudinal axis of plates **20**, **50** (FIG. **3**B).

In this orientation, rotation of axle **80** in one direction may cause corresponding outward movement of expansion members **100**, **102** (e.g., towards the ends of axle **80**), and rotation in another opposite direction may cause inward movement of expansion members **100**, **102** (e.g., towards hourglass-shaped member **82**). Such movement of expansion members **100**, **102** may also interact with angled surface **22**, **52** on plates **20**, **50** to cause corresponding expansion or collapse of implant **10** (e.g., within an intervertebral disc space), as shown in FIGS. **2**A-B. In particular, movement of expansion members **100**, **102** generally towards the ends of axle **80** may cause such members **100**, **102** to ride up angled surfaces **22**, **52** on plates **20**, **50** and thereby cause expansion of implant **10**. Further, with top and bottom surfaces **108**, **110** of expansion members **100**, **102** being angled in the manner discussed above, the movement of plates **20**, **50** may be generally uniform. In other words, were respective planes drawn along outer bone-contacting surfaces **24**, **54** of plates **20**, **50**, upon expansion of implant **10**, such planes would remain in generally the same orientation with respect to one another (i.e., due to top and bottom surfaces **108**, **110** of expansion members **100**, **102** being set flush against angled surfaces **22**, **52**). It is also contemplated that, in one embodiment, the aforementioned planes (and thus outer bone-contacting surfaces **24**, **54**) may be arranged at lordotic angles to one another. This may appropriately accommodate lordosis of adjacent vertebral bodies, if present. Such lordotic angles may also be maintained upon expansion of implant **10**.

During the above-described expansion of implant **10**, axle **80** may rotate within channels **27**, **57**, and particularly: (1) hourglass-shaped member **82** may rotate within cutout **78**; (2) engagement nut **90** within semi-circular openings **25**, **55**; and (3) stop nut **94** within semi-circular openings **29**, **59**. Further, as noted above, due to the reverse threading of threaded sections **84**, **86**, upon rotation of axle **80**, expansion members **100**, **102** may move towards or away from one another (i.e., in opposing directions). Such movement of expansion members **100**, **102** may also be limited by engagement **90** and stop **94** nuts, and hourglass-shaped member **82**. In addition, during expansion of implant **10**, expansion members **100**, **102** may be stabilized via side walls **44**, **74** of inner surfaces **26**, **76**, and posts **36** may limit and/or prevent over-expansion of implant **10**. Indeed, as expansion members **100**, **102** move plates **20**, **50** apart, the head **32** of posts **36** may slide within elongate apertures **64** in plate **50** until such a point as head **32** contacts stop surface **65**, as shown in FIG. **2**B. Thus, posts **36** may act to prevent over distraction of implant **10**. Further, posts **36** may also operate to stabilize implant **10** upon expansion, since sections of posts **36** are engaged with both top and bottom plates **20**, **50** during expansion. In other words, posts **36** may serve to provide torsional and/or compressive stability to plates **20**, **50** in one embodiment.

As such, in use, implant **10** may be inserted into the intervertebral disc space of a patient, with outer bone-contacting surfaces **24**, **54** engaging adjacent vertebrae, and such implant **10** may be expanded in the manner described above. Further details pertaining to this method of expansion, and the insertion of the implant **10** within an intervertebral space, are set forth in subsequent sections.

Referring to FIGS. **4**A-B, there is shown an instrument **120** engageable with the aforementioned implant **10**, and usable to place implant **10** at the treatment site (e.g., within the intervertebral disc space). Instrument **120** may generally include: (1) a shaft **122** with a sleeve **128** overlying the shaft **122**; (2) distal **124** and proximal **126** ends; (3) a socket **130** for engaging with engagement nut **90**; and (4) a rotatable handle **132** connected to socket **130**, such that rotation of handle **132** may cause rotation of socket **130** and expansion of implant **10** (e.g., when instrument **120** is engaged with engagement nut **90**). Distal end **124** of instrument **120** may also include fingers **134**, **136** that are engageable with dovetail-shaped projections **40**, **70**, and may be actuated via a knob **138** situated adjacent proximal end **126** of instrument **120**. Thus, instrument **120** may provide a useful tool for a user in the insertion and/or expansion of implant **10**, as detailed more fully below.

As shown in FIG. **4**A, handle **132** of instrument **120** may be connected to a rod (not shown) extending generally within and along shaft **122** of instrument **120**. The rod may extend to distal end **124** of instrument **120** and may terminate in socket **130**, which in one embodiment may be configured to engage with engagement nut **90**. In some instances, socket **130** may be a Torx-type socket for engaging with an engagement nut **90** having Torx structure. A separate handle **142** may also be provided adjacent proximal end **126**, such handle **142** extending generally outward from instrument **120**. Instrument **120** may also include a grip **144**. Handle **142** and grip **144** may allow the user to effectively grasp instrument **120** during insertion of implant **10** into the intervertebral disc space.

FIG. **4**A further depicts a knob **138** adjacent proximal end **126** that is rotatable about a longitudinal axis of shaft **122**. An interior of knob **138** may include internal threading for cooperating with an actuator (not shown) connected to sleeve **128**. The threading within knob **138** may be configured such that, upon rotation of knob **138** in one direction, the actuator and sleeve **128** may move longitudinally towards distal end **124**; and, upon rotation of knob **138** in an opposing direction, the actuator and sleeve **128** may move longitudinally towards proximal end **126**.

A viewing window **148** may also be provided with instrument **120**, as shown in close-up in FIG. **4**B, for indicating to a user of instrument **120** the particular mode in which instrument **120** is situated (e.g., "implant" mode, "distract" mode, or "remove" mode). An indicator **150** may be housed within viewing window **148**, and a series of markings **152** may also be situated adjacent the window **148**. Further, in one embodiment, wording or other information may be provided proximate viewing window **148** and markings **152** to inform a user of the mode in which instrument **120** is placed.

Referring to FIGS. **5**A-B, distal end **124** of shaft **122** of instrument **120** may be provided with resilient fingers **134**, **136** running along opposing sides of shaft **122**, and positioned within channels (not shown) in shaft **122**. Each finger **134**, **136** may include an end having generally angled surfaces **154** for engaging with projections **40**, **70** on implant **10**. In one embodiment, fingers **134**, **136** may be shaped to conform to the dovetail shape of projections **40**, **70**.

In use, referring still to FIGS. **5**A-B, distal end **124** of instrument **120** may be positioned adjacent dovetail-shaped projections **40**, **70** of implant **10** so that socket **130** of instrument **120** may be attached to engagement nut **90**. Specifically, as shown in the progression between FIGS. **5**A-B, resilient fingers **134**, **136** may be inserted over projections **40**, **70** with sleeve **128** in its retracted position. Such position of sleeve **128** may, in one embodiment, correspond to the "remove" mode shown in FIG. **8**A. Upon insertion of fingers **134**, **136** over projections **40**, **70**, fingers **134**, **136** may translate outwards to accommodate the shape of projections **40**, **70**. After full insertion of fingers **134**, **136** over projections, angled surfaces **154** may seat within or accommodate the shape of projections **40**, **70**. Stated differently, since fingers **134**, **136** may be biased to remain within the channels in shaft **122**, after insertion of fingers **134**, **136** over projections **40**, **70**, fingers **134**, **136** may return to their normal un-translated state and conform to the shape of projections **40**, **70**. Such is shown in detail in FIG. **5**B.

With socket **130** connected to engagement nut **90** and fingers **134**, **136** situated about projections **40**, **70**, sleeve **128** of instrument **120** may then be translated longitudinally via knob **138** until such a point as sleeve **128** contacts implant **10**, as shown in FIGS. **6**A-B. This position of sleeve **128** may correspond to the "implant" mode of instrument **120**, which may be indicated by the movement of indicator **150** within viewing window **148**. In particular, movement of sleeve **128** may cause movement of indicator **150** within window **148**, such that indicator **150** becomes aligned with a marking **152** corresponding to the "implant" mode of instrument **120**, as shown in FIG. **6**A. Further, as sleeve **128** moves longitudinally in the manner described above, fingers **134**, **136** may be compressed against projections **40**, **70**, thereby securing instrument **120** to implant **10**. Implant **10** may then be inserted into the intervertebral disc space via instrument **120**, such that outer bone-contacting surfaces **24**, **54** engage upper and lower vertebral bodies. The approach for implantation of implant **10**, in some cases, may be a posterior or posterior-lateral approach, although other approaches are contemplated. In some embodiments, the vertebral bodies may also be prepared (e.g., through the use of cutting instruments) according to traditional spinal procedures prior to implantation of implant **10**. It is also contemplated that, during insertion of implant **10**, tapered ends **31**, **61** of plates **20**, **50** may provide easier insertion of implant **10** into the intervertebral space via insertion instrument **120**. In addition, the lordotic angle between plates **20**, **50** may, in one embodiment, accommodate lordosis of the adjacent vertebrae, if present.

To distract implant **10** once inserted, instrument **120** may be placed in "distract" mode. Referring to FIGS. **7**A-B, this involves rotating knob **138** in one direction to move the actuator and sleeve **128** toward proximal end **126** of instrument **120**. As sleeve **128** moves toward proximal end **126**, indicator **150** may also move within viewing window **148** so as to line up with the particular marking **152** corresponding to "distract" mode. Thus, a user may be informed when instrument **120** is placed in "distract" mode via rotation of knob **138**. With sleeve retracted a sufficient distance towards proximal end **126**, some pressure may be relieved from between fingers **134**, **136** and projections **40**, **70**, thereby allowing plates **20**, **50** to move apart from one another without fingers **134**, **136** inhibiting such movement. Stated differently, sleeve **128** may be retracted towards proximal end **126**, such that fingers **134**, **136** may still retain projections **40**, **70** and implant **10**, but that pressure therebetween is somewhat relieved so as to allow distraction of implant **10**. To achieve such distraction, the user may simply rotate handle **132** (FIG. **4**A) causing socket **130** to rotate within engagement nut **90**. This rotation of engagement nut **90**, as described previously, may cause expansion members **100**, **102** to interact with ramped surfaces **22**, **52** of plates **20**, **50** and force plates **20**, **50** apart. Distraction of plates **20**, **50** in this manner may also cause distraction of adjacent vertebral bodies. It is thusly possible for implant **10** to accommodate varying degrees of intervertebral spacing, as required during different surgeries or with different patients. Implant **10**, in its expanded state as discussed above, is shown in detail in FIG. **7**B.

Referring now to FIGS. **8**A-B, with implant **10** inserted into the intervertebral disc space, instrument **120** may be placed in "remove" mode, which again may be indicated by movement of indicator **150** within viewing window **148**. In particular, knob **138** may be rotated in one direction causing movement of sleeve **128** towards proximal end **126** of instrument **120** and corresponding movement of indicator **150**. Further, during movement of sleeve **128** towards proximal end **126**, fingers **134**, **136** may be fully released and allowed to resiliently deform outwards as instrument **120** is removed from about projections **40**, **70**. Instrument **120** may then be removed from the surgical site and implant **10** left to affect fusion of the adjacent vertebral bodies. To achieve improved fusion, it is also contemplated that bone-chips, synthetic graft material, or other biocompatible material may be inserted within the intervertebral disc space prior to or during the implantation of implant **10**, and such material may adhere to the apertures in plates **20**, **50** (e.g., apertures **30**) provided for in-growth.

An alternate embodiment implant **210** is shown in FIG. **9**. Due to the similarity between the structures of implants **10**, **210**, like numerals will refer to like elements and, predominantly, only the structural differences between implants **10**, **210** will be highlighted. Thus, apart from the below-mentioned distinguishing features, it is contemplated that implants **10**, **210** may have the same structure and may operate in the same manner (e.g., as set forth above) to accomplish the same purpose.

Referring to FIG. **9**, implant **210** may include top and bottom plates **220**, **250**, such plates including, inter alia: (1) outer bone-contacting surfaces **224**, **254** and opposed inner surfaces **226**, **256**; (2) projections **240**, **270**, which in one embodiment may be dovetail-shaped; (3) apertures **234**, **264** for receiving posts **236** and nuts **238**; (4) recessed and raised center portions **242**, **272**; and (5) angled surfaces **222**, **252** for engaging with expansion members **300**, **302**. Other similar features to implant **10** are also present in implant **210**; and, although not discussed in detail herein, such features are indicated by like reference numerals in the figures.

Several differentiating features of implant **210** will now be described, such features providing improvements in the operation of expandable implant **210**. Referring to FIG. **9**, implant **210** may include an axle **280** disposed between top and bottom plates **220**, **250**, with axle **280** including a center member **282** that is slightly different in shape than hourglass-shaped member **80** of implant **10**. Even so, center member **282** of axle **280** may include opposed discs **400** for engaging with cutouts **402** formed in bottom plate **250**, and a center portion having a reduced diameter for seating within cutout **278**, as shown in detail in FIG. **12**A. With center member **282** situated in bottom plate **250** as described, axle **280** may be longitudinally stabilized with respect to plate **250** (e.g., through the interaction of opposed discs **400** and cutouts **402**), as is the case with axle **80** of implant **10**.

Implant **210** may also include expansion members **300**, **302** having top and bottom surfaces **308**, **310** that are angled in the manner described with reference to expansion members **100**, **102**, as shown in FIGS. **11**A-B, but expansion members **300**, **302** may also have vertically-extensive projections **312**, **314** extending outward therefrom. Expansion members **300**, **302** may also include a set (or one or more) of pins **316** extending from the sides of members **300**, **302**. Vertically-extensive projections **312**, **314** of expansion members **300**, **302** may be received in elongate apertures **230** formed in top and bottom plates **220**, **250**, such apertures **230** being configured to allow translation of vertically-extensive projections **312**, **314** during expansion of implant **210**. Pins **316** of expansion members **300**, **302** may ride along slots **318** formed within side walls **244**, **274** situated adjacent angled surfaces **222**, **252** for guiding expansion members **300**, **302** during expansion of implant **210**, as shown in detail in FIGS. **9** and **12**A-B.

In use, implant **210** may be implanted and/or expanded in much the same manner as implant **10**. Particularly, it is contemplated that insertion instrument **120** may be modified only slightly to properly operate with and engage implant **210**, and to distract such implant **210** after implantation. For example, while it is contemplated that engagement nut **290** of implant **210** may include Torx structure, it is shown in the figures as a hexagonal nut **290** (FIGS. **9**, **11**A-B). Thus, socket **130** of instrument **120** may be modified to accommodate this structure, and to engage with engagement nut **290** in the manner described in relation to implant **10**. To be exact, such modified socket **130** may be inserted over engagement nut **290**, and rotated via handle **132** so as to expand implant **210**. It is also contemplated that instrument **120** may be placed into the various modes (e.g., "implant" mode, "distract" mode, and/or "remove" mode) upon engaging, distracting, and/or separating from implant **210**, as discussed previously. Significantly, however, during expansion of implant **210** through the use of instrument **120**, several structures of implant **210** may operate differently to provide a more stabilized and improved distraction procedure.

In one embodiment, referring now to FIGS. **9** and **12**A-B, during expansion of implant **210** via the interaction between socket **130** and engagement nut **290**, expansion members **300**, **302** may engage with angled surfaces **222**, **252**; but, during separation of expansion members **300**, **302** via the reverse threading of threaded sections **284**, **286**, pins **316** extending from expansion members **300**, **302** may ride along slots **318** formed in respective side walls **244**, **274** of top and bottom plates **220**, **250**. The engagement between pins **316** and slots **318** may act to stabilize the movement of expansion members **300**, **302**, and may also serve to limit the expansion of implant **210**. Indeed, slots **318** may terminate at one section of side walls **244**, **274**, and pins **316** may abut this section upon full expansion of implant **210** to prohibit further movement of expansion members **300**, **302** (e.g., away from one another). In one embodiment, pins **316** may be situated on diagonally opposite sides of each respective expansion member **300**, **302**, although it is contemplated that additional pins **316** may be used (e.g., on all four (4) corners of expansion members **300**, **302**). The engagement between pins **516** and slots **518** may also, at least partially, serve to keep plates **220**, **250** in registration with one another during distraction.

An additional stabilization and/or expansion-limiting feature may be included with implant **210** in the form of elongate apertures **230**. In particular, referring to FIGS. **10**A-**11**B, during expansion of implant **210** via the use of instrument **120**, vertically-extensive projections **312**, **314** of expansion members **300**, **302** may interact with elongate apertures **230** in top and bottom plates **220**, **250** to stabilize such members **300**, **302** and plates **220**, **250**. As shown in the progression between FIGS. **10**A-**10**B and **11**A-**11**B, vertically-extensive projections **312**, **314** may be arranged within elongate apertures **230** of plates **220**, **250**; and, upon expansion of implant **210**, vertically-extensive projections **312**, **314** may translate within apertures **230**, such that plates **220**, **250** and expansion members **300**, **302** are stabilized during distraction. Upon reaching an end of apertures **230**, expansion members **300**, **302** may also be limited from further outward movement. Apertures **230** may also, like apertures **30** of implant **10**, operate to receive bone graft or other osteoinductive material to facilitate fusion of adjacent vertebral bodies upon implantation of implant **210**. Although not discussed in detail herein, the remainder of steps pertaining to the implantation and/or expansion of implant **210**, and its interaction with instrument **120**, is again substantially identical to that discussed above with respect to implant **10**.

Another embodiment of an expandable implant, implant **410**, is shown in FIGS. **13**A-**15**. Here, like numerals will refer to like elements, with the structural differences between implants **10**, **210**, **410** being discussed. Thus, as with above, apart from the distinguishing features detailed in subsequent sections, it is contemplated that implants **10**, **210**, **410** may have the same structure and operate in the same manner to accomplish the same purpose. Here, it is worthwhile to note that, while FIG. **15** only depicts top plate **420**, bottom plate **450** is a mirror image thereof, and thus, FIG. **15** is an accurate representation of both plates **420**, **450** (e.g., with like reference numerals referring to like elements).

Referring to FIGS. **13**A and **15**, implant **410** may include top and bottom plates **420**, **450** with angled inner surfaces **422**, **452** for engaging with expansion members **500**, **502**, much like implants **10**, **210**. Further, expansion members **500**, **502** of implant **410** may also include vertically-extensive projections **512**, **514** for engaging with elongate apertures **430** in plates **420**, **450**, such that upon expansion of implant **410**, vertically-extensive projections **512**, **514** may translate within apertures **430**. Other similar features to implants **10**, **210** are also included with implant **410**, such as: (1) outer bone-contacting surfaces **424**, **454** with teeth or serrations **428**, **458**; (2) tapered ends **431**, **461** of plates **420**, **450**; (3) dovetail-shaped projections **440**, **470**; (4) slots **518** in side walls **444**, **474** of plates **420**, **450**; and (5) expansion members **500**, **502** including pins **516** for engaging with slots **518**. Yet, other features, such as the distraction mechanism of implant **410**, may operate differently than found with implants **10**, **210**.

Referring to FIG. **13**B, the distraction mechanism of implant **410** may include a rod or axle **480**, a capture mechanism **530**, and a containment ring **532**. Axle **480**, like axles **80**, **280**, may be threaded in one embodiment, and may include separate sections **484**, **486** with left-handed and right-handed threads. An engagement nut **490** structure may also be disposed on one end of axle **480**, and a center of axle may include a radially-extending flange **534** and a press-fit region **536**.

Capture mechanism **530** may include a set of apertures **538**, **540** for receiving a portion of axle **480**, and a slot **542** for receiving containment ring **532**. Slot **542** may be dimensioned to allow free movement of containment ring **532** and axle **480** once situated therein. In one embodiment, aperture **538** of capture mechanism **530** may have a diameter that is larger than aperture **540** so as to allow flange **534** to be received in aperture **538**. Further, each aperture **538**, **540** may be smaller in diameter than an outer diameter of containment ring **532**. In a particular embodiment, containment ring **532** includes an inner diameter such that, upon insertion of press-fit region **536** into containment ring **532**, a dimensional interference is established therebetween.

Apart from the differences between distraction mechanisms amongst implants **10**, **210**, **410**, implant **410** may also include plates **420**, **450** with apertures **550** for receiving a portion of capture mechanism **530**, as shown in FIG. **14**. Inner surfaces **426**, **456** of plates **420**, **450** may also include structure (e.g. a housing **560**) for stabilizing capture mechanism **530** (and thus axle **480**) in a longitudinal direction, as shown in FIG. **15**. In one embodiment, plates **420**, **450** also include openings **520** through which pins **516** may be inserted. Similarly, expansion members **500**, **502** may include openings **522** for receiving pins **516**.

In use, the distraction mechanism of implant **410** may be situated between plates **420**, **450** such that axle **480** is inserted into capture mechanism **530** and through containment ring **532**, as shown in FIG. **14**. In particular, containment ring **532** may be disposed within slot **542** in capture mechanism **530**, and axle **480** may be inserted through apertures **538**, **540**. To be exact, axle **480** may be inserted through containment ring **532** until such a point as press-fit region **536** is situated within containment ring **532** and flange **534** is housed within aperture **538** and abuts containment ring **532**. In this orientation, press-fit region **536** may interact with containment ring **532** to establish a dimensional interference between such structures, such that axle **480** may be securely retained within capture mechanism **530**. To be exact, the interaction between flange **534** and containment ring **532** may prevent movement of axle **480** in one direction, and the cooperation between press-fit region **536**, containment ring **532**, and slot **542** may prevent movement of axle **480** in another opposing direction. With axle situated in capture mechanism **530** in the manner described above, capture mechanism **530** may then be inserted into apertures **550** in plates **420**, **450**.

Capture mechanism **530**, axle **480**, and expansion members **500**, **502** may be situated between plates **420**, **450**, with the inner surfaces **426**, **456** of plates **420**, **450** facing one another, as discussed above, and pins **516** may be inserted through openings **520** in plates **420**, **450** and into openings **522** in expansion members **500**, **502**. Indeed, pins **516** may be press-fit into openings **522** in expansion members **500**, **502**, such that pins **516** are firmly retained in expansion members **500**, **502**. Pins **516** are also designed to ride within slots **518** to limit movement of expansion members **500**, **502**, and such pins **516** may also serve to keep plates **420**, **450** firmly connected together. In other words, as at least one pin **516** on each expansion member **500**, **502** engages with a slot **518** in top plate **420**, and at least one pin **516** with a slot **518** in bottom plate **450**, such plates **420**, **450** may be securely retained together via the interaction between pins **516** and slots **518**. A terminal portion of slots **518** may also serve to prevent over-expansion of implant **410**, as discussed above with respect to implant **210**.

Implant **410** may also interact with instrument **120** in the same manner as implants **10**, **210** (e.g., for purposes of implantation and/or distraction). For instance, rotation of handle **132** with respect to engagement nut **490** in one direction may cause expansion members **500**, **502** to move outwardly, and pins **516** to engage with slots **518**. Such movement of expansion members **500**, **502** may also cause outward movement or distraction of plates **420**, **450**, as with implants **10**, **210**; and additional rotation of handle **132** may cause pins **516** of expansion members **500**, **502** to engage with a terminal portion of slots **518** to prevent further outward movement of expansion members **500**, **502**.

What is more, during the aforementioned movement of expansion members **500**, **502**, vertically-extensive projections **512**, **514** may translate within apertures **430** in plates **420**, **450**, and apertures **550** in plates **420**, **450** may interact with capture mechanism **530**. Stated differently, as expansion members **500**, **502** engage with angled surfaces **422**, **522** to distract implant **410** (e.g., via use of instrument **120**), apertures **550** in plates **420**, **450** may slide along portions of capture mechanism **530**, vertically-extensive projections **512**, **514** may translate within apertures **430**, and pins **516** may ride within slots **518**. Such movement of expansion members **500**, **502** may therefore serve to stabilize implant **410** during distraction. For instance, the interaction between vertically-extensive projections **512**, **514** and apertures **430**, and apertures **550** and capture mechanism **530**, may provide torsional and/or compressive stability to implant **410** during distraction, and pins **516** may act as distraction-limiting features. Thus, as with implants **10**, **210**, implant **410** may provide an expandable implant with improved features for maintaining stability and/or controlling distraction during replacement of an intervertebral disc.

In the devices shown in the figures, particular structures are shown as being adapted for use in the implantation, distraction, and/or removal of an expandable implant according to the present invention(s). The invention(s) also contemplates the use of any alternative structures for such purposes, including structures having different lengths, shapes, and/or configurations. For example, as alluded to above, although certain structures are used for socket **130** and engagement nut **90**, **290**, **490** (e.g., Torx or hexagonal), it is contemplated that a variety of different socket/nut combinations may be used, such as square, triangular, etc.

In addition, while angled surfaces **22**, **52**, **222**, **252**, **422**, **452** are shown in the figures as being predominantly flat, it is also contemplated that surfaces **22**, **52**, **222**, **252**, **422**, **452** may be curved in one embodiment so as to facilitate expansion of implants **10**, **210**, **410**. Top and bottom surfaces **108**, **110**, **308**, **310**, **508**, **510** of expansion members **100**, **102**, **300**, **302**, **500**, **502** may likewise be shaped to accommodate the curvature of angled surfaces **22**, **52**, **222**, **252**, **422**, **452**, as previously discussed with respect to implants **10**, **210**, **410**.

Although the invention(s) herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention(s). It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention(s) as defined by the appended claims.

It will also be appreciated that the various dependent claims and the features set forth therein can be combined in different ways than presented in the initial claims. It will also be appreciated that the features described in connection with individual embodiments may be shared with others of the described embodiments.

The invention claimed is:

1. An expandable intervertebral implant comprising:

top and bottom plates having inner and outer surfaces and an aperture extending through the inner and outer surfaces of at least one of the top and bottom plates, the inner surfaces facing each other and each having a ramp surface;

an actuator situated between the inner surfaces of the top and bottom plates; and

first and second expansion members coupled to the actuator and located between the inner surfaces of the top and bottom plates, at least one of the first and second expansion members having a vertical projection extending outwardly therefrom,

wherein rotation of the actuator in opposing directions causes the first and second expansion members to move toward and away from one another along a longitudinal axis of the actuator, resulting in movement of the top and bottom plates along a vertical axis perpendicular to the longitudinal axis, the vertical projection being received and guided at least partially within the aperture while the top and bottom plates move along the vertical axis, wherein the aperture is elongated in a direction substantially aligned with the longitudinal axis of the actuator to allow the vertical projection to translate within the aperture at least in a direction substantially parallel with the longitudinal axis of the actuator.

2. The expandable intervertebral implant of claim **1**, wherein the top and bottom plates each include a projection extending outwardly from an end of the respective top or bottom plate.

3. The expandable intervertebral implant of claim **2**, wherein the actuator includes an engagement nut at an end thereof, the engagement nut being located between the projections of the top and bottom plates.

4. The expandable intervertebral implant of claim **3**, wherein the projections and engagement nut are adapted to be engaged by an insertion instrument.

5. The expandable intervertebral implant of claim **1**, wherein the top and bottom plates each include at least one aperture, and the first and second expansion members each have a vertical projection extending outwardly therefrom, the projections being received and guided within the apertures while the top and bottom plates move along the vertical axis.

6. The expandable intervertebral implant of claim **5**, wherein each of the first and second expansion members are wedge-shaped and include a hole adapted to receive a portion of the actuator.

7. The expandable intervertebral implant of claim **6**, wherein the hole of the first expansion member extends along a first axis and the vertical projection of the first expansion member extends along a second axis transverse to the first axis, and wherein the hole of the second expansion member extends along a third axis, and the vertical projection of the second expansion member extends along a fourth axis transverse to the third axis.

8. The expandable intervertebral implant of claim **1**, further including first and second post members, the post members being at least partially received within first and second sets of apertures extending through the top and bottom plates.

9. The expandable intervertebral implant of claim **8**, further including first and second nuts, the first nut coupled to a distal end of the first post to secure the first post in the first set of apertures, and the second nut coupled to a distal end of the second post to secure the second post in the second set of apertures.

10. The expandable intervertebral implant of claim **1**, wherein the inner surface of at least one of the top and bottom plates has a first recessed portion for housing an intermediate portion of the actuator.

11. The expandable intervertebral implant of claim **10**, wherein the inner surface of the at least one of the top and bottom plates has second and third recessed portions each having a dimension larger than the first recessed portion for housing first and second opposed discs of the actuator.

12. The expandable intervertebral implant of claim **1**, wherein the first and second expansion members each include at least one lateral projection received within a corresponding lateral slot situated adjacent the ramp surface of each of the top and bottom plates.

13. The expandable intervertebral implant of claim **1**, wherein the actuator includes first and second threaded portions, the first and second threaded portions having oppositely facing threads configured to engage threads of the first and second expansion members, such that when the actuator is rotated, the first and second expansion members move along the longitudinal axis of the actuator in opposite directions.

14. An expandable intervertebral implant comprising:

top and bottom plates having inner and outer surfaces, the inner surfaces facing each other and each having a ramp surface;

an actuator situated between the inner surfaces of the top and bottom plates;

first and second expansion members coupled to the actuator and located between the inner surfaces of the top and bottom plates, the first and second expansion members each having a horizontal portion with at least one projection extending outward therefrom,

wherein rotation of the actuator in opposing directions causes the horizontal portion of the first and second expansion members to translate along the ramp surfaces toward and away from one another along a longitudinal axis of the actuator, resulting in movement of the top and bottom plates along a vertical axis perpendicular to the longitudinal axis, the projections of the horizontal portions being received within at least one lateral slot situated adjacent each ramp surface as the top and bottom plates move along the vertical axis, and wherein the lateral slots each include a portion forming a stop surface, such that each of the lateral slots is closed at one section, and the first and second projections are adapted to interact with the respective stop surface to prevent further movement of the first and second expansion members away from one another in a direction substantially aligned with the longitudinal axis of the actuator; and

first and second post members, the post members being at least partially received within first and second sets of apertures extending through the top and bottom plates,

wherein the inner surfaces of the top and bottom plates each include a recess adjacent the respective ramp surface, and the first and second expansion members each include a vertical portion adapted to translate within at least one of the recesses during movement of the top and bottom plates along the vertical axis, and wherein the recesses are apertures extending through the inner and outer surfaces of the top and bottom plates.

15. The expandable intervertebral implant of claim **14**, wherein the inner surface of at least one of the top and bottom plates has a first recessed portion for housing an intermediate portion of the actuator.

16. The expandable intervertebral implant of claim **15**, wherein the inner surface of the at least one of the top and bottom plates has second and third recessed portions each having a dimension larger than the first recessed portion for housing first and second opposed discs of the actuator.

17. The expandable intervertebral implant of claim **14**, wherein the actuator includes first and second threaded portions, the first and second threaded portions having oppositely facing threads configured to engage threads of the first and second expansion members, such that when the actuator is rotated, the first and second expansion members move along the longitudinal axis of the actuator in opposite directions.

18. The expandable intervertebral implant of claim **14**, wherein the horizontal portion of the first and second expansion members includes at least a first and second projection extending therefrom, the first projection being received within a lateral slot situated adjacent the ramp surface of the top plate, and the second projection being received within a lateral slot situated adjacent the ramp surface of the bottom plate.

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